Exhibit A

EXHIBIT B

UNITED STATES DISTRICT COURT
Western District of Texas
WACO DIVISION

JENS H.S. NYGAARD	§	
	§	
vs.	§	NO: WA:20-CV-00234-ADA
	§	
FEDERATION INTERNATIONALE DE L'AUTOMOBILE, FORMULA ONE MANAGEMENT LTD., DELTA TOPCO LTD., MERCEDES-BENZ GRAND PRIX LTD., RED BULL TECHNOLOGY LTD., RED BULL RACING LTD., FERRARI S.P.A., SCUDERIA FERRARI S.P.A., DALLARA AUTOMOBILI S.P.A., DAIMLER AG, LEWIS HAMILTON, CHARLES LECLERC, FERRARI N.V., FORMULA ONE WORLD CHAMPIONSHIP LTD.	§	

CLAIM CONSTRUCTION DECLARATION OF STEPHEN R. SYSON

I, Stephen R. Syson, depose and state as follows:

1. My name is Stephen R. Syson, I am over the age of 21, of sound mind and body, and capable of making this Declaration. I make this Declaration based upon my personal and professional knowledge. The statements contained herein are correct.

2. I make this declaration in support of the Plaintiff, Jens H. S. Nygaard's response to Defendants' Proposed Claim Construction, regarding U.S. Patent 7,494,178, **"VEHICLE AND A STRENGTHENING MEMBER FOR A VEHICLE."**

3. I have been retained as an expert witness on behalf of the Plaintiff to give my opinions on the subject of how a person of ordinary skill in the relevant art would view Mr. Nygaard's claims in the context of the patent and the state of the art at the time of the original application, March 29, 2004.

4. I am charging my regular hourly rate for this engagement, $425 per hour. My compensation is paid for my time, regardless of my opinions or positions in this case. I consider it important to my business and to my own values that I give fair, honest opinions and convey them truthfully to the Court.

I. BACKGROUND

5. A copy of my CV is attached as Exhibit A. I received a Bachelor's degree in Mechanical Engineering from General Motors' Institute (GMI), and a Master's degree in Engineering from Case Western Reserve University in 1970.

6. While attending GMI, I was employed by General Motors as a student engineer at General Motors of Canada, Limited and General Motors Design Staff. I was also employed at General Motors Design Staff as a Research Engineer from August, 1969 through February of 1971. At the Design Staff, I measured driver eye positions for the automotive industry study that led to SAE Recommended Practice J1050. I am familiar with both the manufacturing and design of General Motors' vehicles as well as various other vehicles, including Indycars and Formula One, Two, Three and E cars.

7. In February of 1971, I transferred to the Safety Research and Development Laboratory at the General Motors Proving Grounds. I worked at the Proving Grounds through August, 1978 as an engineer in the restraints, structures and analytical groups. Among other things, I was responsible for analyzing the crash test, sled test and field accident performance of both structures and restraint systems on GM vehicles.

8. I moved to California in 1982. I was employed by MCR Technology (formerly Minicars) as an engineer and manager for approximately four years. I had been head of both the engineering and design groups there. MCR Technology is located in Goleta, California. While at MCR, I was involved in several government contract programs to develop vehicles for improved

crashworthiness, including Research Safety and Modified Integrated Vehicle programs. This work involved vehicle crash testing and evaluation of vehicle structure and occupant restraint system performance. In 1982, my partner and I formed Syson - Hille and Associates. In 2010, I formed the Syson Corporation. In 2017, I moved to Las Vegas.

9. I am a member of the Society of Automotive Engineers (SAE), a former member of the SAE Impact Simulation Sub-Committee, and a member of the American Academy of Forensic Sciences.

10. I have more than fifty years of education, training and experience in the field of automotive engineering, which includes accident investigation and reconstruction, vehicle crashworthiness and the study and evaluation of passenger restraint systems, vehicle structures and occupant protection in both on-road and off-road vehicles. I am familiar with driver sight lines and points of view from my experience in automotive design and safety research. I have been qualified as an expert witness in numerous federal and state courts around the United States on issues of accident reconstruction, vehicle crashworthiness, occupant protection and restraint system design, testing and performance.

11. I attended my first Formula One race at Silverstone in 1954. I have had a continuing interest in automobile racing since that event. Over the years, I have also had continuous involvement in the design and building of race cars. While I was at General Motors in the 1970s, I designed and helped build a late model stock car and built a vehicle, which I raced in Sports Car Club of America, MCSCC and WHRRC races across the midwestern United States. I resumed racing in 1984, and won numerous races including winning an SCCA Northern Pacific Divisional Championship in 1990. The vehicles that I raced were sports coupes and GT

cars that were licensed in California and both driven on the highway and on race tracks (with the required safety equipment) all over the western United States, and twice at Road Atlanta.

12. As a consultant, I have reviewed the performance of thousands of road vehicles and off-road vehicles, some of which were equipped with rollover protective structures, and some were designed to deflect objects around the occupant compartment. All of my race cars had rollover protective structures as part of the required safety equipment.

13. The Nygaard patent is for vehicle safety, of road and other vehicles, by the addition of a strengthening structure (member) that has structural and deflective properties that protect the occupant(s) of a vehicle without sacrificing field of vision.

II. LEVEL OF SKILL IN THE ART

14. In their invalidity claims defendants discuss a person of ordinary skill in the art ("POSITA"). In my opinion, at the relevant time of the application, and for that matter, also today, a POSITA would have formal education or self-study of automotive safety, or experience, or a combination of education and experience, in the design of automotive vehicles, including racing cars, with at least a functional understanding of the concept of binocular vision at a working level. I would expect this person to know aspects of automotive safety built into or added to a vehicle, such as the functions of deflection and structural strength of A, B and C pillars. A POSITA would also have an understanding of sight lines and driver's point of view, as well as binocular vision, as depicted in figures 15 and 23 of the Nygaard patent. A POSITA would understand the patent, and that claims 1, 2 and 4 extend to the vehicles named in the patent. A POSITA could alternatively have a combination of experience in dealing with design, sightlines and safety, and/or other formal education that relates to designing structures for vehicle safety, and/or binocular vision and field of view while driving or operating a vehicle.

15. I was familiar with the knowledge a person of ordinary skill in the art would have had at the time of the Nygaard Patent application (March 29, 2004) and had more than that level of skill and education, myself at that time, and continuing through today.

III. RELEVANT INDUSTRY TERMINOLOGY

16. The terminology in the industry relevant to the patent has not changed as being relevant to understanding the patent since the application was first filed on March 29, 2004. The following terms and phrases in the patent have the same meaning today as they did on March 29, 2004, including but not limited to, "road vehicle," "racing cars," "road," "windscreen," "centre line," "strengthening member," "form of a truncated sheared triangular pyramid," "binocular vision," "conventional passenger motor cars," "passenger compartment," "bonding, gluing, welding or mechanical welding," "strengthening member," "linearly extending units," "structural units," "A pillar," "B pillar," "C pillar," "head lights," "field of vision," "rollover," "roof crush," "structural," "strengthening," "deflective," "motor racing," "conventional vehicle," "formula racing cars," "driver's position," "vehicle frame" and "conventional passenger motor cars.. Features that have become common in passenger motor cars, such as monitor screens or vehicle sensors, have the same meaning today as at the time of the application. The relevant words in the patent would have been understood by a POSITA in March 2004 in the same way they are understood today. In reading the patent in 2004, 2009, 2012, 2013, 2015, 2017, 2018-2021, a POSITA would understand the relevant words to have the same meaning over the course of this time period. This is shown by the following facts in addition to my own experience and knowledge in this industry:

a) FIA's glossary (definitions) of "Automobile" and "Formula One car" contained in its "Technical Regulations" have not changed. A "formula racing car" was unconventional at the time of the application, and is still considered

unconventional today when compared to "conventional passenger motor cars." Attached as Exhibits B and C are FIA definitions contained in their "Technical Regulations" from 2003 and 2004.[1]

b) Further, the figures in the patent specification also confirm that the meaning of the text has not changed since the application. The figures depicting a "conventional passenger motor car" (e.g., figs. 35-62) are recognizable as such today by a POSITA. The figures depicting a racing car (figs. 63-74) likewise would be recognized as depicting race cars both in 2004 and today. The A pillars in figure 26B would be recognized as A pillars today.

c) In addition, an open cockpit race car had the same overall general appearance in 2004 as opposed to today (but for the Halo or Aeroscreen).

d) The drawings of passenger cars in the patent are immediately recognizable as a minivan and a sedan. For example, A 2004 Toyota Camry looks very much like a 2017 Toyota Camry, and both of them resemble the "conventional passenger car" in the patent's figures.

e) The patent refers to well-known components that have the same names today as they did then, such as "rear view mirror," "short-range radar detector," "A pillar," "object sensor," "collision," as well as other examples.

17. The dictionary definitions I reference throughout my declaration would be read the same way with the same meaning in 2004 and today.

[1] An electric vehicle today would be understood as an electric vehicle, but today such a vehicle is no longer experimental or even necessarily unconventional. But the meanings of the actual words are the same.

IV. DISPUTED TERMS

A. "road vehicle" (claims 1 and 4)

Plaintiff's Construction	Defendants' Construction
Ordinary meaning, or "A vehicle designed for driving on a road."	"a vehicle constructed for traveling on a road and not a racetrack"

18. Defendants' definition does not appear in the specification or claims of the patent. The specification and claims make clear that a road vehicle describes any vehicle designed to drive on a road, and neither the patent nor the understanding of a POSITA provides any basis to define a given vehicle as not being a "road vehicle" simply because it often operates on private paved surfaces as well as public ones.

19. Claims 1 and 4 relate to the first aspect of the invention, and "road vehicle" appears in these claims (not in claim 2.) (Col. 1, lines 47-55)

> *Accordingly, in a first aspect, the present invention provides a road vehicle comprising at least one strengthening member fixed to a structure of the vehicle, and extending in front of the driver's position, the strengthening member being dimensioned so that it will not prevent the driver seeing an object which is at least 2 m from the front windscreen, when the driver uses binocular vision and without requiring the driver to move the driver's head.*

20. At column 2, lines 7-23, the patent discusses applying the first aspect of the invention to unconventional cars (e.g., unconventional in 2004 era), such as electric cars and racing cars.

> *The strengthening member of the present invention can also be applied to vehicles, which are not constructed in the same way as a normal road vehicle,* ***for example formula racing cars or unconventional energy saving vehicles, which*** *are currently being experimented with. Many of these vehicles have a pod-like curved windscreen which extends around the driver and/or passengers. Where the vehicle has a windscreen, whether in a conventional vehicle or an unconventional vehicle, the strengthening member is preferably fixed to a structure of the vehicle and extending adjacent the front windscreen, the strengthening member extending*

> *between lateral edges of the front windscreen. In some racing cars, there is no windscreen at all, in which case the strengthening member can be provided extending in front of the driver's position.*

21. A POSITA would understand the above language to contrast "formula racing cars" and "unconventional energy saving vehicles" with "a normal road vehicle," not a "road vehicle." In other words, the patent describes electric cars and racing cars as "road vehicles," though not normal ones.

22. The patent reinforces this point by explicitly applying the "first aspect" of the invention to race cars (Col. 15, lines 7-10):

> *FIGS.* ***63-74*** *show various embodiments of strengthening member according to the first aspect of the invention, mounted in a race car.*

23. Figures 63-74 would also make it clear to a POSITA intending to design a racing car or other road vehicle that the patent applies to racing cars. The patent describes these figures as applying to a racing car (e.g., Col. 22, lines 14-21), and they are immediately recognizable as a racing car as shown in these examples:

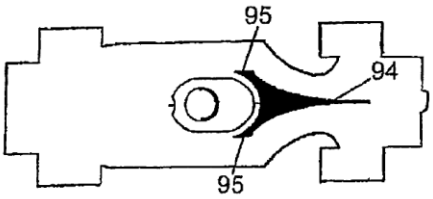


Fig. 63

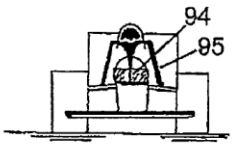


Fig. 64

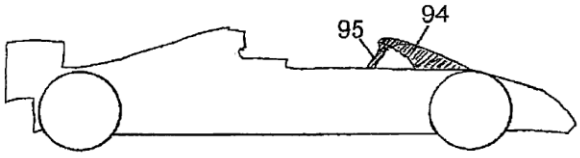


Fig. 65

Defendants' construction would exclude this entire set of figures, as well as significant portions of the specification, e.g., Col. 2, lines 7-23, and Col. 22, lines 14-51.

24. Even setting aside the patent, it is my opinion that Defendants are trying to create a distinction between "road vehicles" and racecars that a POSITA would not understand to exist. Indycars, Formula One cars and Formula E cars have raced on city streets, closed public highways and circuits designed to mimic public roads, such as Circuit Of The Americas. A road circuit is a road, and is often used by vehicles such as passenger cars for racing and test purposes. Historically, for example, Riverside International Raceway was used for Formula One Races, Indycar races, and for endurance testing of passenger cars. Traditional Indycar races were held on oval tracks, like the Indianapolis Motor Speedway, and also for many years on road courses like Circuit of the Americas and on city streets like St. Petersburg, Florida or Long Beach, California. Traditional Formula One races were often conducted on city streets (Monaco), or closed public highways (Spa, Nurburgring), as well as at Monza, which was a race track that included part of a banked oval. Formula E racing is of relatively new vintage, and the great majority of those races have been on city streets: The U.S. Formula E Grand Prix (ePrix) has, for example, been held on New York City Streets.

25. F1, Formula E, IndyCar and IndyLights races have races each year on city streets. A typical example of a Formula E car has been fielded by Mercedes-Benz:, see Exhibit D:

> "**We Race The City.**
> *Racing in ABB FIA Formula E is the latest chapter in over 125 years of motorsports at Mercedes-Benz. We embrace the challenge that racing in city centres around the globe poses while developing a new generation of electric race cars."*

26. In short, a POSTIA would not understand a car to be a "road vehicle" only when driving on a public road or street, and Formula One and other race cars are driven on public roads and streets in any event.

27. Documents published by Defendants and their industry also support my opinions. For example, in the 2003 Formula One Technical Regulations, the definition of "automobile" covers race cars, and in fact the regulations define a "Formula One Car" as a type of automobile:

ARTICLE 1: DEFINITIONS

1.1 Formula One Car :
An automobile designed solely for speed races on circuits or closed courses.

1.2 Automobile :
A land vehicle running on at least four non-aligned complete wheels, of which at least two are used for steering and at least two for propulsion.

The above definitions are the same in the 2020 regulations.

28. Formula 1's definition of "Automobile" captures all of the patent's figures and descriptions of a "road vehicle."

29. And Formula 1's definition of a "Formula One Car" says clearly that it is a specific type of "automobile," which is another sign that Defendants' proposed negative limitation (excluding a specific type of "automobile" from the definition of "road vehicle") is wrong.

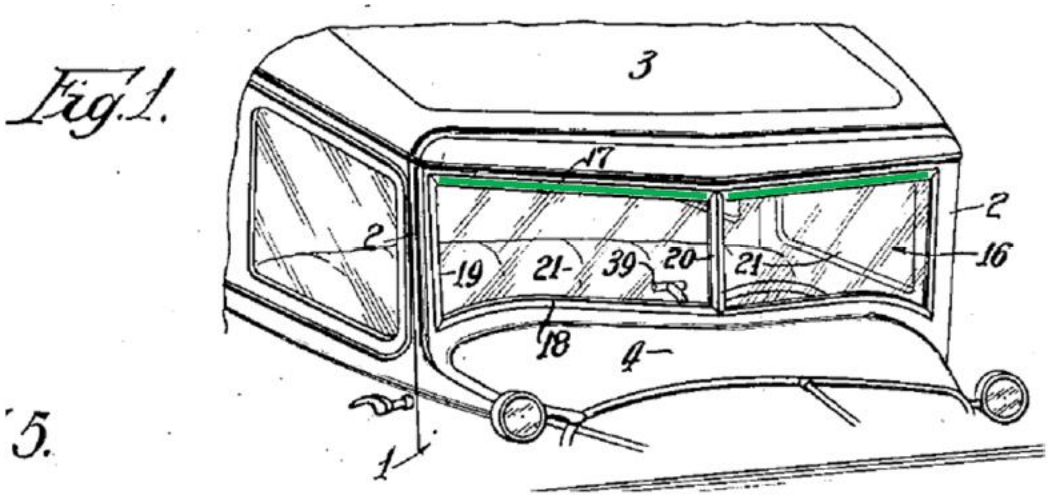
30. A POSITA therefore would read "road vehicle," in 2004 and today, as including "race car," "Formula One Car." "IndyCar," "racing car," "conventional passenger motor car," among other vehicles.

B. "strengthening member" (claims 1, 2 and 4)

Plaintiff's Construction	Defendants' Construction
"A member added to a vehicle for protecting the driver or passengers."	Plain and ordinary meaning.

31. The Defendants' lack of a claim construction for "strengthening member" is confusing, in light of the prior art they have cited against the patent. For example, Defendants have put forth prior art that is an old-fashioned roadster with two panes of glass for a windshield,

held together and propped up at the center by a post. See Exhibit E, Defendants' invalidity chart A-1, p. 3:



32. The post on this vehicle (and similar designs), only hold the windshield's panes together and in place, and are not designed to provide a "strengthening" function. Defendants therefore seem to be suggesting a scope of "strengthening member" beyond its plain and ordinary meaning.

33. Additionally, in my opinion the patent uses the term "strengthening member" in a specific way, making clear that the patented "strengthening member" has a protective function. For example, Col. 1, L. 43-46:

> *The present inventor has set out to provide a strengthening member for a vehicle for protecting the driver or passengers in the vehicle from rollover roof crush and from penetration of objects through the windscreen.*

C. "strengthening member… for fixing to a structure of the vehicle and for extending in front of the driver's position" (claim 1) / "strengthening member fixed to a structure of the vehicle and extending in front of the driver's position" (claim 4):

Plaintiff's Construction	Defendants' Construction
Ordinary meaning, or "a member that has structural and deflective safety properties fixed to the vehicle substantially on the center line extending in front of the driver's position."	"a strengthening member fixed to a structure of the vehicle and located ahead of the driver's position, along the longitudinal axis of the vehicle, when seen in side view; it is not

	necessary that the strengthening member is placed directly in front of the driver's position"

34. The patent itself defines what is meant by "in front of the driver":

> *By "in front of the driver" it is meant that the strengthening member is located ahead of the driver's position, along the longitudinal axis of the vehicle, when seen in side view. It is not necessary that the strengthening member is placed directly in front of the driver's position.* ***Many vehicles are designed with a notional centre line. The driver's position is conventionally located to one side of this centre line. In this case, the strengthening member may be located on the centre line, on the same side of the centre line of the driver's position or to the other side. Preferably, it is located substantially on the centre line****.*

(Col. 2, lines 23-34.)

35. Defendants' construction excerpts language from the above definition, but does not account for the bolded portion of the paragraph which puts the strengthening member in the first aspect of the invention (claims 1 and 4) along the center line. A POSITA would have used the full definition provided by the inventor of "in front of the driver" and understood the position of the strengthening member in claims 1 and 4 as set forth in that definition.

36. Furthermore, because these same last two sentences in the above-excerpted paragraph read,

> *In this case, the strengthening member may be located on the centre line, on the same side of the centre line of the driver's position or to the other side. Preferably, it is located substantially on the centre line.*

a POSITA would know the strengthening member should be on the center line, especially on a formula racing car, where the driver sits near or on the center line of the vehicle.

37. A POSITA, e.g., an engineer or designer familiar with automotive vehicles, would also understand from the repeated references in the specification of how "A" pillars interact with

the strengthening member in the first aspect of the invention (Claims 1 and 4), the strengthening member is not one of the "A" pillars. For example, figure 26 shows an example strengthening member in the center of the windshield area, with the two "A" pillars at the outer edges of the windshield area:

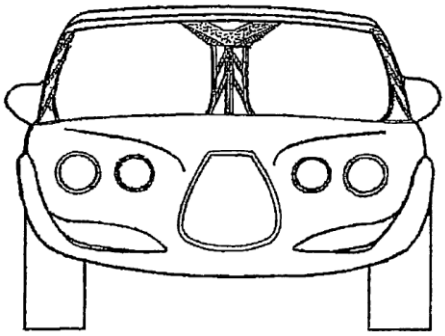


Fig. 26A

38. This distinction also reinforces a POSITA's understanding that the strengthening member of the invention is substantially on the center line of the vehicle.

D. "the strengthening member being dimensioned so that, when in use, the strengthening member will not prevent the driver from seeing an object which is at least 2 m from the front windscreen, when the driver uses binocular vision" (claim 1) / "the strengthening member is dimensioned so that the strengthening member will not prevent the driver from seeing an object which is at least two meters from the front windscreen, when the driver uses binocular vision" (claim 4)

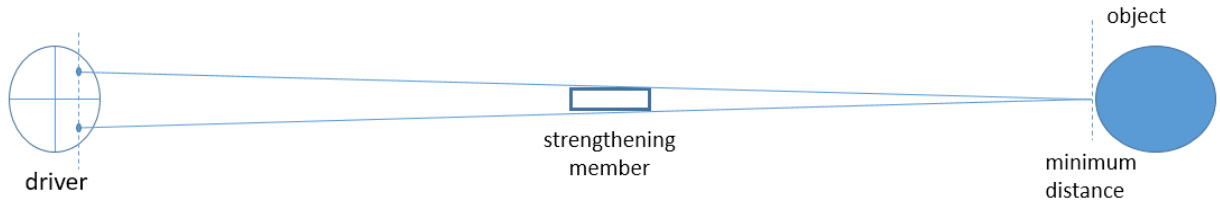
Plaintiff's Construction	Defendants' Construction
These phrases set forth the location or orientation of the strengthening member: "one portion of the structure located substantially on the center line of the vehicle, being dimensioned so that, when in use the strengthening member will not prevent the driver from seeing an object which is at least 2 m from the location for a front windscreen when the driver uses binocular vision."	Indefinite

39. I understand from counsel that a claim is indefinite if a POSITA cannot determine the scope of the claim with reasonable certainty, and that a claim term is indefinite if a POSITA would not understand with reasonable certainty what that term means in the context of the patent.

40. The patent is clear throughout that the invention is designed to protect the occupant(s) of the vehicle without unduly obstructing the driver's vision. The patent also clearly explains that this is accomplished by making the width of the strengthening member less than the spacing between the driver's eyes:

> *Most drivers have an eye separation falling in the range 5.5-6.5 cm. The width of the structural unit is preferably less than this and preferably less than 65% of minimum normal eye separation.*

Col. 5, L. 48-51. A POSITA, such as an automotive engineer or designer with reasonable knowledge of sight lines and binocular vision would understand that the narrowing of the strengthening member allows for a driver using binocular vision to see "around" or "through" the strengthening member to obstructions on the other side, as shown in this example top view of the driver and strengthening member:



A POSITA would understand that a thin member or pole in front of the driver would not obscure vision of the driver in a meaningful way because each eye captures a separate, but overlapping image. When the brain processes these images, very little of the field of vision is impacted, and as shown above the driver's vision is not impacted at all for objects falling beyond the minimum distance (described in the claims as at least 2 meters from the front windscreen area).

41. A POSITA therefore would understand both how the invention works and what the above language means in light of the specification. A POSITA would also understand what structures would be covered by the patent's claims 1 and 4. Defendants have not yet explained why they believe this term is indefinite, so I may offer further opinions once they provide that explanation.

E. "front windscreen" (claims 1 and 4)

Plaintiff's Construction	Defendants' Construction
Ordinary meaning, or "A screen in front of the driver."	"a front windshield/window of the road vehicle"

42. The phrase in Defendants' construction is never used in the patent. The Nygaard patent claims use the term "front windscreen" to describe a reference point that is used to assure visibility near the front end of the vehicle, when a strengthening member is placed along the centerline, considering the driver's binocular vision. The invention itself does not incorporate a windscreen in any of its structures, and does not purport to "invent" a windscreen. In addition, claim 1 relates only to the safety structure, not to other parts of the vehicle it is integrated with, which further illustrates the invented safety structure does not include a front windshield.

43. A "front windscreen" is simply a point of reference to use in installation of the safety device. The Nygaard Patent makes this clear at Col. 2, lines 12-22:

> *Many of these vehicles have a pod-like curved windscreen which extends around the driver and/or passengers. Where the vehicle has a windscreen, whether in a conventional vehicle or an unconventional vehicle, the strengthening member is preferably fixed to a structure of the vehicle and extending adjacent the front windscreen, the strengthening member extending between lateral edges of the front windscreen. In some racing cars, there is no windscreen at all, in which case the strengthening member can be provided extending in front of the driver's position.*

44. Additionally, a "windscreen" is not limited to a "front windshield/window" as Defendants propose. A windscreen simply deflects air from its normal path (for purposes of aerodynamics and air flow). Many different structures therefore can serve as a "windscreen" depending on the type of vehicle and goals of deflecting the air. For example, a structure as simple as a small non-opaque attachment to the lip of the front of the cockpit of a racing vehicle is a windscreen because it deflects airflow. In fact, such attachments are called "windscreens" by racing teams and racing enthusiasts. The same is true of some passenger cars, as shown in this photo of Dallara's Stradale Sports Car base model.[2]

45. For these reasons as well as those I discuss in Paragraphs 39-41 for the claim terms about the dimensioning of the strengthening member, it is my opinion that a POSITA would understand "front windscreen" to refer to a place on the road vehicle, not the part as installed in the road vehicle.

[2] https://www.reddit.com/r/carporn/comments/d45ikn/dallara_stradale/, Exhibit F. See also article on this Dallara model, Exhibit G.

46. However, several F1 cars still have had windscreens at selected events, including Lewis Hamilton's 2019 Mercedes that he drove in the 2019 U.S. Grand Prix:

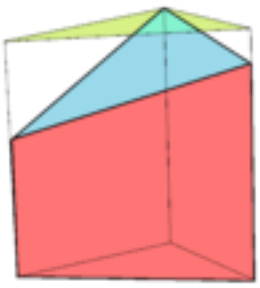
47. The windscreen is more easily seen in this photo of a Mercedes F1 car prior to introduction of the Halo.

48. When installed, these wind deflection features are all located in the same area of the vehicle as an actual windshield on a conventional vehicle.

F. "[wherein the strengthening member has] the form of a triangular prism which has been sheared in a vertical plane or the form of a truncated sheared triangular pyramid" (claims 1 and 4)

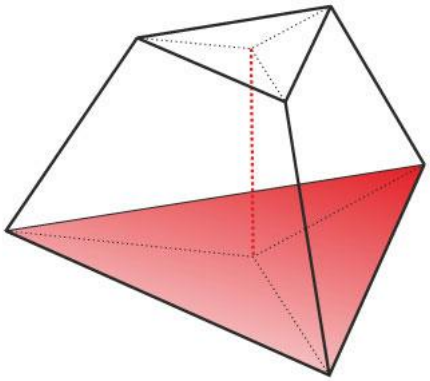
Plaintiff's Construction	Defendants' Construction
"the form of a triangular prism which has been sheared in a vertical plane": Ordinary meaning. "the form of a truncated sheared triangular pyramid": "the form of a three dimensional triangular pyramid that has one angle on the center line of the vehicle with the top of the pyramid sheared off so that the outline of a top plane would be smaller than the outline of the bottom plane of the form."	Indefinite

49. It is my opinion that a POSITA would understand the scope of this term with reasonable certainty. Both shapes are defined in geometric terms, and are illustrated in Wikipedia.com and polyhedr.com, respectively.



A truncated triangular prism with its top face truncated at an oblique angle

Exhibit H, https://en.wikipedia.org/wiki/Triangular_prism#Truncated_triangular_prism.



Truncated Triangular Pyramid

Exhibit I, https://polyhedr.com/truncated-triangular-pyramid.html.

50. A POSITA would understand that the words "form of" refer to the reasonable understanding that the exact measurements, angles, and whether or not the lines forming the structure are perfectly straight are not critical, as long as the reinforcement is in the approximate form of the figure. A POSITA would understand what the patent covered in designing a road vehicle or other structures.

51. Defendants have not yet explained why they believe this term is indefinite, so I may offer further opinions once they provide that explanation.

G. "second linearly extending structural unit"/"the second structural units" (claim 2)

Plaintiff's Construction	Defendants' Construction
Ordinary meaning	Indefinite

52. It is my opinion that a POSITA would understand the scope of this term with reasonable certainty. In context, the phrase is, " A strengthening member for mounting in a vehicle, formed of at least three first linearly extending structural units placed in a triangular arrangemeent [sic], for extending from the front structure of the vehicle and second linearly extending structural unit joining the at least three first linearly extending units,"

53. Presumably, the indefiniteness postulated by the Defendants is from the typographical errors in the claim: "arrangemeent" and "second structural unit – second structural units." A POSITA would give this a common sense interpretation, understanding "arrangemeent" is "arrangement," and when reading "unit" then "units" interpret that as either a unit or units. The arrangement in figure 56 meets this description: "In FIGS. **55-57,** various further types of strengthening member are shown.," Col. 15, lines 17-18.

54. Literally speaking, this phrase means "second," referring to a second unit different from the first unit; "linearly extending," referring to extending in the form of a line; "structural units," referring to a part of the structure. Other examples of the second structural units are identified in the patent drawings and patent language. For a typical four door sedan, the patent language states (Column 15, Lines 15 – 27):

> *FIGS. 1 and 2 show a first embodiment of strengthening member and a vehicle comprising the strengthening member according to the present invention mounted inside the passenger compartment. A strengthening structure **1** comprises a strengthening member **2** according to the invention which, when assembled, extends adjacent the front windscreen **103** of the vehicle. The strengthening member **2** is connected to a second strengthening member which comprises a pair of ribs **4** which are substantially parallel to one another and which are placed inside and contacting the roof structure **5** of the vehicle. The two ribs **4** come together at a point where they contact a third strengthening member **6** which in use contacts the rear window **7** of the vehicle.*

The following figures show the second strengthening member(s) **4** attach at the top of the strengthening member **2** for a conventional passenger car:

And the following figures show an implementation for a formula car, where three first linearly extending structural units in a triangular arrangement are joined by a second linearly extending structural unit:

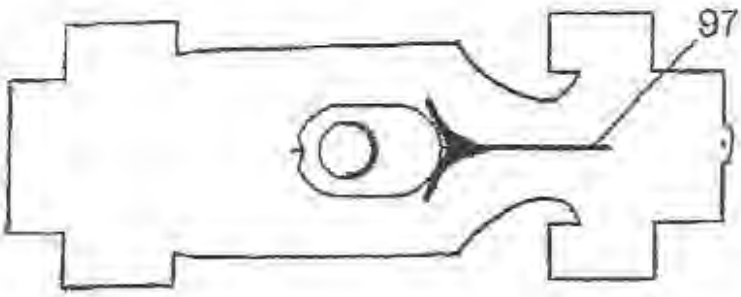


Fig. 69

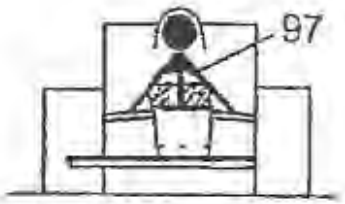


Fig. 70

55. Defendants have not yet explained why they believe this term is indefinite, so I may offer further opinions once they provide that explanation.

I declare under penalty of perjury that the foregoing is true and correct.

By: _____ executed on January 22, 2021
Stephen R. Syson

EXHIBIT A

THE SYSON CORP

The Syson Corporation

4187 Carpinteria Ave., Suite 8-10

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Stephen R. Syson

EDUCATION:

General Motors Institute, BSME –Automotive, 1970
Case Western Reserve University, MS – Engineering, 1970

EXPERIENCE:

Syson Corporation, Carpinteria, California, 2010 - Date

Syson-Hille and Associates, Goleta, California 1982 – 2010

General Partner: Performe analysis of motor vehicle collisions with emphasis on vehicle crashworthiness and restraint system performance.

MCR Technology, Inc. Goleta, California 1978 – 1982

Head, Engineering and Design Groups: Supervised and conducted analysis and design of vehicle structures, utilizing both lumped mass simulation of vehicle crashes and finite element modeling of structural systems. Responsible for the structural designs of the Paratransit Vehicle (taxi for handicapped passengers) and the Large Research Safety Vehicle. Conducted dynamic analysis of motor vehicle ride, handling and braking, and developed vehicle design criteria.

General Motors Safety Research and Development General Motors Proving Grounds, Milford, Michigan 1971 – 1978

Senior Project Engineer. Directed Program to validate the technique of modeling vehicle front structures by lumped masses and non-linear springs. Revised front structures using static testing and computer modeling. Used computer simulations correlated with test results to develop active and passive belt restraint systems. Set up test protocol for HYGE sled, laboratory, and barrier tests to evaluate vehicle restraint system performance. Supervised and conducted development of advanced air cushion restraint systems for various GM vehicles.

General Motors Design Staff – Technical Center. Warren, Michigan 2/1965 – 12/1967 & 8/1969 –2/1971

Research Engineer – Safety and Human Performance Group. Performed studies in human factors, seating comfort, driver visibility, control reach and control force application.

MEMBERSHIPS:

Society of Automotive Engineers
American Academy of Forensic Sciences
Alpha Tau Iota, Honorary Engineering Fraternity
Association for the Advance of Automotive Medicine
American Society of Mechanical Engineers

The Syson Corp, Engineering | 7112 Via Campanile Avenue, Las Vegas, NV 89131 | 702-998-4934

THE SYSON CORP

Chief Engineering Officer:
Stephen R. Syson

Education:

- Mr. Syson received his Bachelor's degree in mechanical engineering, automotive option, from General Motors Institute, now known as Kettering University
- Mr. Syson received numerous awards including being made a member of the Management Honor Society, the Robots honorary society and Alpha Tau Iota honorary engineering fraternity
- Mr. Syson was awarded a G.M. fellowship to get his Master's degree

Case Institute of Technology:

Mr. Syson received his Master's degree in engineering.

Mr. Syson specialized in structural analysis and automatic control systems

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EXHIBIT B

2003 FORMULA ONE TECHNICAL REGULATIONS

SUMMARY

ARTICLE 1: DEFINITIONS

1.1 Formula One Car :
An automobile designed solely for speed races on circuits or closed courses.

1.2 Automobile :
A land vehicle running on at least four non-aligned complete wheels, of which at least two are used for steering and at least two for propulsion.

1.3 Land vehicle :
A locomotive device propelled by its own means, moving by constantly taking real support on the earth's surface, of which the propulsion and steering are under the control of a driver aboard the vehicle.

1.4 Bodywork :
All entirely sprung parts of the car in contact with the external air stream, except cameras and the parts definitely associated with the mechanical functioning of the engine, transmission and running gear. Airboxes, radiators and engine exhausts are considered to be part of the bodywork.

1.5 Wheel :
Flange and rim.

1.6 Complete wheel :
Wheel and inflated tyre. The complete wheel is considered part of the suspension system.

1.7 Automobile Make :
In the case of Formula racing cars, an automobile make is a complete car. When the car manufacturer fits an engine which it does not manufacture, the car shall be considered a hybrid and the name of the engine manufacturer shall be associated with that of the car manufacturer. The name of the car manufacturer must always precede that of the engine manufacturer. Should a hybrid car win a Championship Title, Cup or Trophy, this will be awarded to the manufacturer of the car.

1.8 Event :
An event shall consist of official practice and the race.

1.9 Weight :
Is the weight of the car with the driver, wearing his complete racing apparel, at all times during the event.

1.10 Racing weight :
Is the weight of the car in running order with the driver aboard and all fuel tanks full.

1.11 Cubic capacity :
The volume swept in the cylinders of the engine by the movement of the pistons. This volume shall be expressed in cubic centimetres. In calculating engine cubic capacity, the number Pi shall be 3.1416.

1.12 Supercharging :
Increasing the weight of the charge of the fuel/air mixture in the combustion chamber (over the weight induced by normal atmospheric pressure, ram effect and dynamic effects in the intake and/or exhaust system) by any means whatsoever. The injection of fuel under pressure is not considered to be supercharging.

1.13 Cockpit :
The volume which accommodates the driver.

1.14 Sprung suspension :
The means whereby all complete wheels are suspended from the body/chassis unit by a spring medium.

1.15 Survival cell :
A continuous closed structure containing the fuel tank and the cockpit.

1.16 Camera :
Television cameras the dimensions of which are defined in Drawing 6.

1.17 Camera housing :
A device which is identical in shape and weight to a camera and which is supplied by the relevant Competitor for fitting to his car in lieu of a camera.

1.18 Cockpit padding :
Non-structural parts placed within the cockpit for the sole purpose of improving driver comfort and safety. All such material must be quickly removable without the use of tools.

1.19 Brake caliper :
All parts of the braking system outside the survival cell, other than brake discs, brake pads, caliper pistons, brake hoses and fittings, which are stressed when subjected to the braking pressure. Bolts or studs which are used for attachment are not considered to be part of the braking system.

1.20 Electronically controlled :
Any command system or process that utilises semi-conductor or thermionic technology.

ARTICLE 2 : GENERAL PRINCIPLES

2.1 Role of the FIA :
The following technical regulations for Formula 1 cars are issued by the FIA.

2.2 Amendments to the regulations :
Amendments to these regulations will be made in accordance with the Concorde agreement.

2.3 Dangerous construction :
The stewards of the meeting may exclude a vehicle whose construction is deemed to be dangerous.

2.4 Compliance with the regulations :
Automobiles must comply with these regulations in their entirety at all times during an Event.
Should a competitor feel that any aspect of these regulations is unclear, clarification may be sought from the FIA Formula One Technical Department. If clarification relates to any new design or system, correspondence must include :

- a full description of the design or system ;
- drawings or schematics where appropriate ;
- the Competitor's opinion concerning the immediate implications on other parts of the car of any proposed new design ;
- the Competitor's opinion concerning any possible long term consequences or new developments which may come from using any such new designs or systems ;
- the precise way or ways in which the Competitor feels the new design or system will enhance the performance of the car.

2.5 Measurements :
All measurements must be made while the car is stationary on a flat horizontal surface.

2.6 Duty of Competitor :
It is the duty of each Competitor to satisfy the FIA technical delegate and the Stewards of the Meeting that his automobile complies with these regulations in their entirety at all times during an Event.
The design of the car, it's components and systems shall, with the exception of safety features, demonstrate their compliance with these regulations by means of physical inspection of hardware or materials. No mechanical design may rely upon software inspection as a means of ensuring its compliance.

ARTICLE 3 : BODYWORK AND DIMENSIONS

For illustrations refer to drawings 1A-5A in the Appendix to these regulations

3.1 Wheel centre line :
The centre line of any wheel shall be deemed to be half way between two straight edges, perpendicular to the surface on which the car is standing, placed against opposite sides of the complete wheel at the centre of the tyre tread.

3.2 Height measurements :
All height measurements will be taken normal to and from the reference plane.

3.3 Overall width :
The overall width of the car, including complete wheels, must not exceed 1800mm with the steered wheels in the straight ahead position. Overall width will be measured when the car is fitted with tyres inflated to 1.4 bar.

3.4 Width ahead of the rear wheel centre line :

3.4.1 Bodywork width ahead of the rear wheel centre line must not exceed 1400mm.

3.4.2 In order to prevent tyre damage to other cars, the top and forward edges of the lateral extremities of any bodywork forward of the front wheels must be at least 10mm thick with a radius of at least 5mm.

3.5 Width behind the rear wheel centre line :
Bodywork width behind the rear wheel centre line must not exceed 1000mm.

3.6 Overall height :
No part of the bodywork may be more than 950mm above the reference plane.

3.7 Front bodywork height :
All bodywork situated forward of a point lying 330mm behind the front wheel centre line, and more than 250mm from the centre line of the car, must be no less than 100mm and no more than 300mm above the reference plane.

3.8 Height in front of the rear wheels :

3.8.1 Other than the rear view mirrors, each with a maximum area in plan view of 12000mm², no bodywork situated more than 330mm behind the front wheel centre line and more than 330mm forward of the rear wheel centre line, which is more than 600mm above the reference plane, may be more than 300mm from the centre line of the car.

3.8.2 No bodywork between the rear wheel centre line and a line 800mm forward of the rear wheel centre line, which is more than 500mm from the centre line of the car, may be more than 500mm above the reference plane.

3.8.3 No bodywork between the rear wheel centre line and a line 400mm forward of the rear wheel centre line, which is more than 500mm from the centre line of the car, may be more than 300mm above the reference plane.

3.9 Bodywork between the rear wheels :

3.9.1 No bodywork situated between the rear wheel centre line and a point lying 330mm forward of it may be more than 600mm above the reference plane.

3.9.2 No bodywork situated between the rear wheel centre line and a point lying 150mm behind it may be more than 450mm above the reference plane.

3.10 Height behind the rear wheel centre line :

3.10.1 Any part of the car more than 150mm behind the centre line of the rear wheels must not be more than 800mm above the reference plane.

3.10.2 No bodywork behind the centre line of the rear wheels, and more than 150mm each side of the longitudinal centre line of the car, may be less than 300mm above the reference plane.

3.10.3 Any bodywork more than 150mm behind the rear wheel centre line which is more than 300mm above the reference plane, and between 75mm and 480mm from the car centre line, must lie in one of two areas when viewed from the side of the car. These areas are situated from 300mm to 375mm and 600mm to 800mm above the reference plane. When these areas are viewed from the side of the car, no longitudinal cross section may have more than three closed sections in the upper area or more than one in the lower.

3.11 Bodywork around the front wheels :
With the exception of brake cooling ducts, in plan view, there must be no bodywork in the area formed by two longitudinal lines parallel to and 400mm and 900mm from the car centre line and two transversal lines, one 350mm forward of and one 800mm behind the front wheel centre line.

3.12 Bodywork facing the ground :

3.12.1 All sprung parts of the car situated more than 330mm behind the front wheel centre line and more than 330mm forward of the rear wheel centre line, and which are visible from underneath, must form surfaces which lie on one of two parallel planes, the reference plane or the step plane. This does not apply to any parts of rear view mirrors which are visible, provided each of these areas does not exceed 12000mm² when projected to a horizontal plane above the car. The step plane must be 50mm above the reference plane.

3.12.2 Additionally, the surface formed by all parts lying on the reference plane must :

- extend from a point lying 330mm behind the front wheel centre line to the centre line of the rear wheels;
- have minimum and maximum widths of 300mm and 500mm respectively ;
- be symmetrical about the centre line of the car ;
- have a 50mm radius (+/-2mm) on each front corner when viewed from directly beneath the car, this being applied after the surface has been defined.

3.12.3 The surface lying on the reference plane must be joined around its periphery to the surfaces lying on the step plane by a vertical transition. If there is no surface visible on the step plane vertically above any point around the periphery of the reference plane, this transition is not necessary.

3.12.4 The peripheries of the surfaces lying on the reference and step planes may be curved upwards with maximum radii of 25 and 50mm respectively. Where the vertical transition meets the surfaces on the step plane a radius, no greater than 25mm, is permitted.
A radius in this context will be considered as an arc applied perpendicular to the periphery and tangential to both surfaces.
The surface lying on the reference plane, the surfaces lying on the step plane, the vertical transitions between them and any surfaces rearward of the surfaces lying on the reference or step planes, must first be fully defined before any radius can be applied or the skid block fitted. Any radius applied is still considered part of the relevant surface.

3.12.5 All parts lying on the reference and step planes, in addition to the transition between the two planes, must produce uniform, solid, hard, continuous, rigid (no degree of freedom in relation to the body/chassis unit), impervious surfaces under all circumstances.

Fully enclosed holes are permitted in the surfaces lying on the reference and step planes provided no part of the

car is visible through them when viewed from directly below.

3.12.6 To help overcome any possible manufacturing problems, and not to permit any design which may contravene any part of these regulations, dimensional tolerances are permitted on bodywork situated between a point lying 330mm behind the front wheel centre line and the rear wheel centre line. A vertical tolerance of +/- 5mm is permissible across the surfaces lying on the reference and step planes and a horizontal tolerance of 5mm is permitted when assessing whether a surface is visible from beneath the car.

3.12.7 All sprung parts of the car situated behind a point lying 330mm forward of the rear wheel centre line, which are visible from underneath and are more than 250mm from the centre line of the car, must be at least 50mm above the reference plane.

3.13 Skid block :

3.13.1 Beneath the surface formed by all parts lying on the reference plane, a rectangular skid block, with a 50mm radius (+/-2mm) on each front corner, must be fitted. This skid block may comprise more than one piece but must :

a) extend longitudinally from a point lying 330mm behind the front wheel centre line to the centre line of the rear wheels.
b) be made from an homogeneous material with a specific gravity between 1.3 and 1.45.
c) have a width of 300mm with a tolerance of +/- 2mm.
d) have a thickness of 10mm with a tolerance of +/- 1mm.
e) have a uniform thickness when new.
f) have no holes or cut outs other than those necessary to fit the fasteners permitted by 3.13.2 or those holes specifically mentioned in g) below.
g) have seven precisely placed holes the positions of which are detailed in Drawing 1. In order to establish the conformity of the skid block after use, it's thickness will only be measured in the four 50mm diameter holes and the two forward 80mm diameter holes.
Four further 10 mm diameter holes are permitted provided their sole purpose is to allow access to the bolts which secure the Accident Data Recorder to the survival cell.
h) be fixed symmetrically about the centre line of the car in such a way that no air may pass between it and the surface formed by the parts lying on the reference plane.

3.13.2 Fasteners used to attach the skid block to the car must :

a) have a total area no greater than 40000mm² when viewed from directly beneath the car ;
b) be no greater than 2000mm² in area individually when viewed from directly beneath the car ;
c) be fitted in order that their entire lower surfaces are visible from directly beneath the car.
When the skid block is new, ten of the fasteners may be flush with it's lower surface but the remainder may be no more than 8mm below the reference plane.

3.13.3 The lower edge of the periphery of the skid block may be chamfered at an angle of 30° to a depth of 8mm, the trailing edge however may be chamfered over a distance of 200mm to a depth of 8mm.

3.14 Overhangs :

No part of the car shall be more than 500mm behind the centre line of the rear wheels or more than 1200mm in front of the centre line of the front wheels.
No part of the bodywork more than 200mm from the centre line of the car may be more than 900mm in front of the front wheel centre line.
All overhang measurements will be taken parallel to the reference plane.

3.15 Aerodynamic influence :

Any specific part of the car influencing its aerodynamic performance (with the exception of the cover described in Article 6.5.2 in the pit lane only) :

- Must comply with the rules relating to bodywork.
- Must be rigidly secured to the entirely sprung part of the car (rigidly secured means not having any degree of freedom).
- Must remain immobile in relation to the sprung part of the car.

Any device or construction that is designed to bridge the gap between the sprung part of the car and the ground is prohibited under all circumstances.
No part having an aerodynamic influence and no part of the bodywork, with the exception of the skid block in 3.13 above, may under any circumstances be located below the reference plane.

3.16 Upper bodywork :

3.16.1 With the exception of the opening described in Article 3.16.3, when viewed from the side, the car must have bodywork in the triangle formed by three lines, one vertical passing 1330mm forward of the rear wheel centre line, one horizontal 550mm above the reference plane and one diagonal which intersects the vertical at a point 940mm above the reference plane and the horizontal 330mm forward of the rear wheel centre line.
Any bodywork within this area situated less than 1000 mm from the rear wheel centre line must be arranged symmetrically about the car centre line and must be at least 200mm wide when measured at any point along a second diagonal line parallel to and 200mm vertically below the first.
Furthermore, over the whole area between the two diagonal lines, the bodywork must be wider than a vertical isosceles triangle lying on a lateral plane which has a base 200mm wide lying on the second diagonal line.

3.16.2 When viewed from the side, the car must have no bodywork in the triangle formed by three lines, one vertical 330mm forward of the rear wheel centre line, one horizontal 950mm above the reference plane, and one diagonal which intersects the vertical at a point 600mm above the reference plane and the horizontal at a point 1030mm forward of the rear wheel centre line.

3.16.3 In order that a car may be lifted quickly in the event of it stopping on the circuit, the principal rollover structure must incorporate a clearly visible unobstructed opening designed to permit a strap, whose section measures 60mm x 30mm, to pass through it.

3.17 Bodywork flexibility :

3.17.1 Bodywork may deflect no more than 5mm vertically when a 500N load is applied vertically to it 700mm forward of the front wheel centre line and 625mm from the car centre line. The load will be applied in a downward direction using a 50mm diameter ram and an adapter 300mm long and 150mm wide. Teams must supply the latter when such a test is deemed necessary.

3.17.2 Bodywork may deflect no more than 10mm vertically when a 500N load is applied vertically to it 400mm forward of the rear wheel centre line and 650mm from the car centre line. The load will be applied in a downward direction using a 50mm diameter ram and an adapter of the same size, Teams must supply the latter when such a test is deemed necessary.

3.17.3 Bodywork may deflect by no more than one degree horizontally when a load of 1000N is applied simultaneously to its extremities in a rearward direction

780mm above the reference plane and 130mm behind the rear wheel centre line.

3.17.4 In order to ensure that the requirements of Article 3.15 are respected, the FIA reserves the right to introduce further load/deflection tests on any part of the bodywork which appears to be (or is suspected of), moving whilst the car is in motion.

ARTICLE 4 : WEIGHT

4.1 *Minimum* weight :
The weight of the car must not be less than **605 kg during each qualifying practice session and no less than 600 kg at all other times during the Event.**

4.2 Ballast :
Ballast can be used provided it is secured in such a way that tools are required for its removal. It must be possible to fix seals if deemed necessary by the FIA technical delegate.

4.3 Adding during the race :
With the exception of fuel, nitrogen and compressed air, no substance may be added to the car during the race. If it becomes necessary to replace any part of the car during the race, the new part must not weigh any more than the original part.

ARTICLE 5 : ENGINE

5.1 Engine specification :

5.1.1 Only 4-stroke engines with reciprocating pistons are permitted.

5.1.2 Engine capacity must not exceed 3000 cc.

5.1.3 Supercharging is forbidden.

5.1.4 All engines must have 10 cylinders and the normal section of each cylinder must be circular.

5.1.5 Engines may have no more than 5 valves per cylinder.

5.2 Other means of propulsion :

5.2.1 The use of any device, other than the 3 litre, four stroke engine described in 5.1 above, to power the car, is not permitted.

5.2.2 The total amount of recoverable energy stored on the car must not exceed 300kJ, any which may be recovered at a rate greater than 2kW must not exceed 20kJ.

5.3 Engine intake air :

5.3.1 Other than injection of fuel for the normal purpose of combustion in the engine, any device, system, procedure, construction or design the purpose or effect of which is any decrease in the temperature of the engine intake air is forbidden.

5.3.2 Other than engine sump breather gases and fuel for the normal purpose of combustion in the engine, the spraying of any substance into the engine intake air is forbidden.

5.4 Exhaust system :
Variable geometric length exhaust systems are forbidden.

5.5 Engine materials :

5.5.1 The basic structure of the crankshaft and camshafts must be made from steel or cast iron.

5.5.2 Pistons, cylinder heads and cylinder blocks may not be composite structures which use carbon or aramid fibre reinforcing materials.

5.6 Starting the engine :
A supplementary device temporarily connected to the car may be used to start the engine both on the grid and in the pits.

5.7 Stall prevention systems :
If a car is equipped with a stall prevention system, and in order to avoid the possibility of a car involved in an accident being left with the engine running, all such systems must be configured to stop the engine no more than ten seconds after activation.

ARTICLE 6 : FUEL SYSTEM

6.1 Fuel tanks :

6.1.1 The fuel tank must be a single rubber bladder conforming to or exceeding the specifications of FIA/FT5-1999, the fitting of foam within the tank however is not mandatory. **A list of approved materials may be found in the Appendix to these regulations.**

6.1.2 All the fuel stored on board the car must be situated between the front face of the engine and the driver's back when viewed in lateral projection. When establishing the front face of the engine, no parts of the fuel, oil, water or electrical systems will be considered. Furthermore, no fuel can be stored more than 300mm forward of the highest point at which the driver's back makes contact with his seat. However, a maximum of 2 litres of fuel may be kept outside the survival cell, but only that which is necessary for the normal running of the engine.

6.1.3 Fuel must not be stored more than 400mm from the longitudinal axis of the car.

6.1.4 All rubber bladders must be made by manufacturers recognised by the FIA. In order to obtain the agreement of the FIA, the manufacturer must prove the compliance of his product with the specifications approved by the FIA. These manufacturers must undertake to deliver to their customers exclusively tanks complying to the approved standards.
A list of approved manufacturers **may be found in the Appendix to these regulations.**

6.1.5 All rubber bladders shall be printed with the name of the manufacturer, the specifications to which the tank has been manufactured and the date of manufacture.

6.1.6 No rubber bladders shall be used more than 5 years after the date of manufacture.

6.2 Fittings and piping :

6.2.1 All apertures in the fuel tank must be closed by hatches or fittings which are secured to metallic or composite bolt rings bonded to the inside of the bladder.
Bolt hole edges must be no less than 5mm from the edge of the bolt ring, hatch or fitting.

6.2.2 All fuel lines between the fuel tank and the engine must have a self sealing breakaway valve. This valve must separate at less than 50% of the load required to break the fuel line fitting or to pull it out of the fuel tank.

6.2.3 No lines containing fuel may pass through the cockpit.

6.2.4 All lines must be fitted in such a way that any leakage cannot result in the accumulation of fuel in the cockpit.

6.3 Crushable structure :
The fuel tank must be completely surrounded by a crushable structure, which is an integral part of the survival cell and must be able to withstand the loads required by the tests in Articles 18.2.1 and 18.3.

6.4 Fuel tank fillers :

Fuel tank fillers must not protrude beyond the bodywork. Any breather pipe connecting the fuel tank to the atmosphere must be designed to avoid liquid leakage when the car is running and its outlet must not be less than 250mm from the cockpit opening. All fuel tank fillers and breathers must be designed to ensure an efficient locking action which reduces the risk of an accidental opening following a crash impact or incomplete locking after refuelling.

6.5 Refuelling :

6.5.1 All refuelling during the race must be carried out at a rate no greater than 12.1 litres per second and by using equipment which has been supplied by the FIA designated manufacturer, details concerning the manufacturer may be found in the Appendix to these regulations. This manufacturer will be required to supply identical refuelling systems, the complete specification of which will be available from the FIA no later than one month prior to the first Championship Event.
Any modifications to the manufacturer's specification may only be made following written consent from the FIA.

6.5.2 A cover must be fitted over the car connector at all times when the car is running on the track. The cover and it's attachments must be sufficiently strong to avoid accidental opening in the event of an accident.

6.5.3 Before refuelling commences, the car connector must be connected electrically to earth.
All metal parts of the refuelling system from the coupling to the supply tank must also be connected to earth.

6.5.4 Refuelling the car on the grid may only be carried out by using an unpressurised container which is no more than 2 metres above the ground.

6.5.5 No fuel on board the car may be more than ten degrees centigrade below ambient temperature.

6.5.6 The use of any device on board the car to decrease the temperature of the fuel is forbidden.

6.6 Fuel sampling :

6.6.1 Competitors must ensure that a one litre sample of fuel may be taken from the car at any time during the Event.

6.6.2 All cars must be fitted with a –2 'Symetrics' male fitting in order to facilitate fuel sampling. If an electric pump on board the car cannot be used to remove the fuel an externally connected one may be used provided it is evident that a representative fuel sample is being taken. If an external pump is used it must be possible to connect the FIA sampling hose to it and any hose between the car and pump must be -3 in diameter and not exceed 2m in length. Details of the fuel sampling hose may be found in the Appendix to these regulations.

6.6.3 The sampling procedure must not necessitate starting the engine or the removal of bodywork (other than the cover over the refuelling connector).

ARTICLE 7 : OIL AND COOLANT SYSTEMS

7.1 Location of oil tanks :
All oil storage tanks must be situated between the front wheel axis and the rearmost gearbox casing longitudinally, and must be no further than the lateral extremities of the survival cell are from the longitudinal axis of the car.

7.2 Longitudinal location of oil system :
No other part of the car containing oil may be situated behind the complete rear wheels.

7.3 Catch tank :
In order to avoid the possibility of oil being deposited on the track, the engine sump breather must vent into the main engine air intake system.

7.4 Transversal location of oil system :
No part of the car containing oil may be more than 700mm from the longitudinal centre line of the car.

7.5 Oil replenishment :
No oil replenishment is allowed during a race.

7.6 Coolant header tank :
The coolant header tank on the car must be fitted with an FIA approved pressure relief valve which is set to a maximum of 3.75 bar gauge pressure, details of the relief valve may be found in the Appendix to these regulations. If the car is not fitted with a header tank, an alternative position must be approved by the FIA.

7.7 Cooling systems :
The cooling systems of the engine must not intentionally make use of the latent heat of vaporisation of any fluid.

7.8 Oil and coolant lines :

7.8.1 No lines containing coolant or lubricating oil may pass through the cockpit.

7.8.2 All lines must be fitted in such a way that any leakage cannot result in the accumulation of fluid in the cockpit.

7.8.3 No hydraulic fluid lines may have removable connectors inside the cockpit.

ARTICLE 8 : ELECTRICAL SYSTEMS

8.1 Software and electronics inspection :

8.1.1 Prior to the start of each season the complete electrical system on the car must be examined and all on board and communications software must be inspected by the FIA Technical Department.
The FIA must be notified of any changes prior to the Event at which such changes are intended to be implemented.

8.1.2 All re-programmable microprocessors must have a mechanism that allows the FIA to accurately identify the software version loaded.

8.1.3 All electronic units containing a programmable device, and which are intended for use at an Event, must be presented to the FIA before each Event in order that they can be identified.

8.1.4 All on-car software versions must be registered with the FIA before use.

8.1.5 The FIA must be able to test the operation of any compulsory electronic safety systems at any time during an Event.

8.2 Start systems :

8.2.1 Any system, the purpose and/or effect of which is to detect when a race start signal is given, is not permitted.

8.2.2 Whichever driver input device is used to initiate the propulsion of the car during the start of a race, a verifiable signal must be provided which indicates it's instant of operation.

8.3 Accident data recorders :
The recorder must be fitted and operated :

- by being rigidly attached to the survival cell using the four 7mm diameter holes provided ;
- in accordance with the instructions of the FIA ;
- symmetrically about the car centre line and with its top facing upwards ;
- with each of its 12 edges parallel to an axis of the car ;
- less than 50mm above the reference plane ;

- in a position which is normally accessible at the start and finish of an Event ;
- in order that the entire unit lies between 40% and 60% of the wheelbase of the car ;
- with its main connector facing forwards ;
- in order that its status light is visible when the driver is in the cockpit ;
- in order that the download connector is easily accessible without the need to remove bodywork.

8.4 Marshal information display :
All cars must be fitted with red, blue and yellow cockpit lights the purpose of which are to give drivers information concerning track signals or conditions. The lights must be LEDs each with a minimum diameter of 5mm and which are fitted in order that they are directly in the driver's normal line of sight. Details of the light control system, which must be fitted to every car, may be found in the Appendix to these regulations.

ARTICLE 9 : TRANSMISSION SYSTEM

9.1 Transmission types :
No transmission system may permit more than two wheels to be driven.

9.2 Clutch control :
All cars must be fitted with a means of disengaging the clutch for a minimum of fifteen minutes in the event of the car coming to rest with the engine stopped. This system must be in working order throughout the Event even if the main hydraulic, pneumatic or electrical systems on the car have failed.
In order that the driver or a marshal may activate the system in less than five seconds, the switch or button which operates it must :

- face upwards and be positioned on the survival cell no more than 150mm from the car centre line ;
- be designed in order that a marshal is unable to accidentally re-engage the clutch ;
- be less than 150mm from the front of the cockpit opening ;
- be marked with a letter "N" in red inside a white circle of at least 50mm diameter with a red edge.

9.3 Gear ratios :
9.3.1 The minimum number of forward gear ratios is 4 and the maximum is 7.

9.3.2 Continuously variable transmission systems are not permitted.

9.4 Reverse gear :
All cars must have a reverse gear operable any time during the Event by the driver when the engine is running.

9.5 Torque transfer systems :
Any system or device the design of which is capable of transferring or diverting torque from a slower to a faster rotating wheel is not permitted.

ARTICLE 10 : SUSPENSION AND STEERING SYSTEMS

10.1 Sprung suspension :
Cars must be fitted with sprung suspension. The springing medium must not consist solely of bolts located through flexible bushes or mountings.
There must be movement of the wheels to give suspension travel in excess of any flexibility in the attachments.
The suspension system must be so arranged that its response is consistent at all times and results only from changes in vertical load applied to the wheels save only for movement permitted by inherent and fixed physical properties.

10.2 Suspension geometry :
10.2.1 Suspension geometry must remain fixed at all times.

10.2.2 Any powered device which is capable of altering the configuration or affecting the performance of any part of the suspension system is forbidden.

10.2.3 No adjustment may be made to the suspension system while the car is in motion.

10.3 Suspension members :
10.3.1 The cross-sections of each member of every suspension component must have an aspect ratio no greater than 3.5:1 and be symmetrical about its major axis. All suspension components may however have sections with an aspect ratio greater than 3.5:1, and be non-symmetrical, provided these are adjacent to their inner and outer attachments and form no more than 25% of the total distance between the attachments of the relevant member.
All measurements will be made perpendicular to a line drawn between the inner and outer attachments of the relevant member.

10.3.2 No major axis of a cross section of a suspension member may subtend an angle greater than 5° to the reference plane when measured parallel to the centre line of the car.

10.3.3 Non-structural parts of suspension members are considered bodywork.

10.3.4 In order to help prevent a wheel becoming separated in the event of all suspension members connecting it to the car failing, two cables, each with separate attachments, must be fitted to connect each wheel/upright assembly to the main structure of the car. The cables and their attachments must be designed in order to help prevent a wheel making contact with the driver's head during an accident.
The length of each cable should be no longer than that required to allow normal suspension movement.
Each complete cable restraint system, including their attachments, must have a minimum tensile strength of 60kN and each cable must be flexible with a minimum diameter of 8mm. However, when fitted to a car utilising a survival cell the type of which was used at an Event during the 2001 Championship season, the tensile strength of the inner and outer attachments may comply with the 2001 Technical Regulations.

10.4 Steering :
10.4.1 Any steering system which permits the re-alignment of more than two wheels is not permitted.

10.4.2 Power assisted steering systems may not be electronically controlled or electrically powered. No such system may carry out any function other than reduce the physical effort required to steer the car.

10.4.3 No part of the steering wheel or column, nor any part fitted to them, may be closer to the driver than a plane formed by the entire rear edge of the steering wheel rim.

10.4.4 The steering wheel, steering column and steering rack assembly must pass an impact test, details of the test procedure may be found in Article 16.5.

ARTICLE 11 : BRAKE SYSTEM

11.1 Brake circuits and pressure distribution :
11.1.1 All cars must be equipped with only one brake system. This system must comprise solely of two separate hydraulic circuits operated by one pedal, one circuit operating on the two front wheels and the other on the two rear wheels. This system must be designed so that if a failure occurs in one circuit the pedal will still operate the brakes in the other.

11.1.2 The brake system must be designed in order that the force exerted on the brake pads within each circuit are the same at all times.

11.1.3 Any powered device which is capable of altering the configuration or affecting the performance of any part of the brake system is forbidden.

11.1.4 Any change to, or modulation of, the brake system whilst the car is moving must be made by the drivers direct physical input, may not be pre-set and must be under his complete control at all times.

11.2 Brake calipers :

11.2.1 All brake calipers must be made from aluminium materials with a modulus of elasticity no greater than 80Gpa.

11.2.2 No more than two attachments may be used to secure each brake caliper to the car.

11.2.3 No more than one caliper, with a maximum of six pistons, is permitted on each wheel.

11.2.4 The section of each caliper piston must be circular.

11.3 Brake discs :

11.3.1 No more than one brake disc is permitted on each wheel.

11.3.2 All discs must have a maximum thickness of 28mm and a maximum outside diameter of 278mm.

11.3.3 No more than two brake pads are permitted on each wheel.

11.4 Air ducts :

Air ducts for the purpose of cooling the front and rear brakes shall not protrude beyond :

- a plane parallel to the ground situated at a distance of 140mm above the horizontal centre line of the wheel ;
- a plane parallel to the ground situated at a distance of 140mm below the horizontal centre line of the wheel ;
- a vertical plane parallel to the inner face of the wheel rim and displaced from it by 120mm toward the centre line of the car.

Furthermore, when viewed from the side the ducts must not protrude forwards beyond the periphery of the tyre or backwards beyond the wheel rim.

11.5 Brake pressure modulation :

11.5.1 No braking system may be designed to prevent wheels from locking when the driver applies pressure to the brake pedal.

11.5.2 No braking system may be designed to increase the pressure in the brake calipers above that achievable by the driver applying pressure to the pedal under static conditions.

11.6 Liquid cooling :

Liquid cooling of the brakes is forbidden.

ARTICLE 12 : WHEELS AND TYRES

12.1 Location :

Wheels must be external to the bodywork in plan view, with the rear aerodynamic device removed.

12.2 Number of wheels :

The number of wheels is fixed at four.

12.3 Wheel material :

All wheels must be made from an homogeneous metallic material.

12.4 Wheel dimensions :

12.4.1 Complete wheel width must lie between 305 and 355mm when fitted to the front of the car and between 365 and 380mm when fitted to the rear.

12.4.2 Complete wheel diameter must not exceed 660mm when fitted with dry-weather tyres or 670mm when fitted with wet-weather tyres.

12.4.3 Complete wheel width and diameter will be measured horizontally at axle height when fitted with new tyres inflated to 1.4 bar.

12.4.4 Wheel bead diameter must lie between 328 and 332mm.

ARTICLE 13 : COCKPIT

13.1 Cockpit opening :

13.1.1 In order to ensure that the opening giving access to the cockpit is of adequate size, the template shown in Drawing 2 will be inserted into the survival cell and bodywork.
During this test the steering wheel, steering column, seat and all padding required by Articles 14.6.1-6 (including fixings), may be removed and :

- the template must be held horizontal and lowered vertically from above the car until its lower edge is 525mm above the reference plane ;
- referring to Drawing 2, the edge of the template which lies on the line d-e must be no less than 1800mm behind the line A-A shown in Drawing 5.

Any measurements made from the cockpit entry template (when referred to in Articles 13.1.3, 14.3.3,15.2.2, 15.4.5, 15.4.6, 15.5.4, 16.3 and 18.4), must also be made whilst the template is held in this position.

13.1.2 The forward extremity of the cockpit opening, even if structural and part of the survival cell, must be at least 50mm in front of the steering wheel.

13.1.3 The driver must be able to enter and get out of the cockpit without it being necessary to open a door or remove any part of the car other than the steering wheel. When seated normally, the driver must be facing forwards and the rearmost part of his crash helmet may be no more than 125mm forward of the rear edge of the cockpit entry template.

13.1.4 From his normal seating position, with all seat belts fastened and whilst wearing his usual driving equipment, the driver must be able to remove the steering wheel and get out of the car within 5 seconds and then replace the steering wheel in a total of 10 seconds.
For this test, the position of the steered wheels will be determined by the FIA technical delegate and after the steering wheel has been replaced steering control must be maintained.

13.2 Steering wheel :

The steering wheel must be fitted with a quick release mechanism operated by pulling a concentric flange installed on the steering column behind the wheel.

13.3 Internal cross section :

13.3.1 A free vertical cross section, which allows the outer template shown in Drawing 3 to be passed vertically through the cockpit to a point 100mm behind the face of the rearmost pedal when in the inoperative position, must be maintained over its entire length.
The only things which may encroach on this area are the steering wheel and any padding that is required by Article 14.6.7.

13.3.2 A free vertical cross section, which allows the inner template shown in Drawing 3 to be passed vertically through the cockpit to a point 100mm behind the face of rearmost pedal when in the inoperative position, must be maintained over its entire length.
The only thing which may encroach on this area is the steering wheel.

13.3.3 The driver, seated normally with his seat belts fastened and with the steering wheel removed must be able to raise both legs together so that his knees are past the plane of the steering wheel in the rearward direction. This action must not be prevented by any part of the car.

13.4 Position of the driver's feet :

13.4.1 The survival cell must extend from behind the fuel tank in a rearward direction to a point at least 300mm in front of the driver's feet, with his feet resting on the pedals and the pedals in the inoperative position.

13.4.2 When he is seated normally, the soles of the driver's feet, resting on the pedals in the inoperative position, must not be situated forward of the front wheel centre line.

ARTICLE 14 : SAFETY EQUIPMENT

14.1 Fire extinguishers :

14.1.1 All cars must be fitted with a fire extinguishing system which will discharge into the cockpit and into the engine compartment.

14.1.2 Any extinguishant listed in the Appendix to the regulations is permitted.

14.1.3 The quantity of extinguishant may vary according to the type of extinguishant used, a list of quantities may be found in the Appendix to these regulations.

14.1.4 When operated, the fire extinguishing system must discharge 95% of its contents at a constant pressure in no less than 10 seconds and no more than 30 seconds.
If more than one container with extinguishant is fitted, they must be released simultaneously.

14.1.5 Each pressure vessel must be equipped with a means of checking its pressure which may vary according to the type of extinguishant used. A list of pressures may be found in the Appendix to the regulations.

14.1.6 The following information must be visible on each container with extinguishant :

a) Type of extinguishant
b) Weight or volume of the extinguishant
c) Date the container must be checked which must be no more than two years after the date of filling.

14.1.7 All parts of the extinguishing system must be situated within the survival cell and all extinguishing equipment must withstand fire.

14.1.8 Any triggering system having its own source of energy is permitted, provided it is possible to operate all extinguishers should the main electrical circuits of the car fail.
The driver must be able to trigger the extinguishing system manually when seated normally with his safety belts fastened and the steering wheel in place.
Furthermore, a means of triggering from the outside must be combined with the circuit breaker switch described in Article 14.2.2. It must be marked with a letter "E" in red inside a white circle of at least 100mm diameter with a red edge.

14.1.9 The system must work in any position, even when the car is inverted.

14.1.10 All extinguisher nozzles must be suitable for the extinguishant and be installed in such a way that they are not directly pointed at the driver.

14.2 Master switch :

14.2.1 The driver, when seated normally with the safety belts fastened and the steering wheel in place, must be able to cut off the electrical circuits to the ignition, all fuel pumps and the rear light by means of a spark proof circuit breaker switch.
This switch must be located on the dashboard and must be clearly marked by a symbol showing a red spark in a white edged blue triangle.

14.2.2 There must also be an exterior switch, with a horizontal handle, which is capable of being operated from a distance by a hook. This switch must be situated at the base of the main roll over structure on the right hand side.

14.3 Rear view mirrors :

14.3.1 All cars must have at least two mirrors mounted so that the driver has visibility to the rear and both sides of the car.

14.3.2 The reflective surface of each mirror must be at least 150mm wide, this being maintained over a height of at least 50mm. Additionally, each corner may have a radius no greater than 10mm.

14.3.3 No part of the reflective surface may be less than 250mm from the car centre line or more than 750mm from the rear of the cockpit entry template.

14.3.4 The FIA technical delegate must be satisfied by a practical demonstration that the driver, when seated normally, can clearly define following vehicles.
For this purpose, the driver shall be required to identify any letter or number, 150mm high and 100mm wide, placed anywhere on boards behind the car, the positions of which are detailed below :

Height : From 400mm to 1000mm from the ground.
Width : 2000mm either side of the centre line of the car.
Position : 10m behind the rear axle line of the car.

14.4 Safety belts :

It is mandatory to wear two shoulder straps, one abdominal strap and two straps between the legs. These straps must be securely fixed to the car and must comply with FIA standard 8853/98.

14.5 Rear light :

All cars must have a red light in working order throughout the Event which :

- has been manufactured as specified in the Appendix to these regulations ;
- faces rearwards at 90° to the car centre line and the reference plane ;
- is clearly visible from the rear ;
- is not mounted more than 100mm from the car centre line ;
- is mounted between 325mm and 400mm above the reference plane ;
- is no less than 450mm behind the rear wheel centre line measured parallel to the reference plane ;
- can be switched on by the driver when seated normally in the car.

The three measurements above will be taken to the centre of the rear face of the light unit.

14.6 Headrests and head protection :

14.6.1 All cars must be equipped with three areas of padding for the driver's head which :

- are so arranged that they can be removed from the car as one part ;
- are located by two horizontal pegs behind the driver' head and two fixings, which are clearly indicated and easily removable without tools, at the front corners ;
- are made from a material which is suitable for the relevant ambient air temperature, details of approved materials and the temperature bands in which they should be used may be found in the Appendix to these regulations ;
- are covered, in all areas where the driver's head is likely to make contact, with two plies of Aramid fibre/epoxy resin composite pre-preg

material in plain weave 60gsm fabric with a cured resin content of 50% (+/-5%) by weight ;
- are positioned so as to be the first point of contact for the driver's helmet in the event of an impact projecting his head towards them during an accident.

14.6.2 The first area of padding for the driver's head must be positioned behind him and be between 75mm and 90mm thick over an area of at least 40000mm².

14.6.3 The two further areas of padding for the driver's head must be positioned directly alongside each side of his helmet. The upper surfaces of these areas of padding must be at least as high as the survival cell over their entire length.
Each area of padding must be between 75mm and 90mm thick over an area of at least 25000mm² and may have a radius of 10mm along it's upper inboard edge. When calculating their area, any part which is greater than 75mm thick and which lies between the front face of the rear area of padding and the forward most part of the driver's helmet whilst he is seated normally, will be taken into account (area 'B' in Drawing 4). The thickness will be measured perpendicular to the car centre line.

14.6.4 Forward of the side areas of padding further cockpit padding must be provided on each side of the cockpit rim. The purpose of the additional padding is to afford protection to the driver's head in the event of an oblique frontal impact and must therefore be made from the same material as the other three areas of padding.
These extensions must :
- be symmetrically positioned about the car centre line and a continuation of the side areas of padding ;
- be positioned with their upper surfaces at least as high as the survival cell over their entire length;
- have a radius on their upper inboard edge no greater than 10mm ;
- be positioned in order that the distance between the two is no less than 360mm ;
- be as high as practicable within the constraints of driver comfort.

14.6.5 All of the padding described above must be so installed that if movement of the driver's head, in any expected trajectory during an accident, were to compress the foam fully at any point, his helmet would not make contact with any structural part of the car.
Furthermore, for the benefit of rescue crews all of the padding described above must be installed using the system described in the Appendix to these regulations. The method of removal must also be clearly indicated.

14.6.6 No part of the padding described above may obscure sight of any part of the driver's helmet when he is seated normally and viewed from directly above the car.

14.6.7 In order to minimise the risk of leg injury during an accident, additional areas of padding must be fitted each side of, and above, the driver's legs.

These areas of padding must :
- be made from a material described in the Appendix to these regulations ;
- be no less than 25mm thick over their entire area ;
- cover the area situated between points lying 50mm behind the centre of the point at which the second roll structure test is carried out and100mm behind the face of the rearmost pedal when in the inoperative position, as shown in Drawing 4 ;
- cover the area above the line A-A shown in Drawing 3.

14.7 Wheel retention :

All cars, whilst under their own power, must be fitted with devices which will retain any wheel in the event of it coming loose.
After the wheel nut is fastened, these devices must be manually fitted in a separate action to that of securing the wheel nut.

14.8 Seat fixing and removal :

14.8.1 In order that an injured driver may be removed from the car in his seat following an accident, all cars must be fitted with a seat which, if it is secured, must be done so with no more than two bolts. If bolts are used they must :
- be clearly indicated and easily accessible to rescue crews ;
- be fitted vertically ;
- be removable with the same tool for all Teams and which is issued to all rescue crews.

14.8.2 The seat must be equipped with receptacles which permit the fitting of belts to secure the driver and one which will permit the fitting of a neck support.

14.8.3 The seat must be removable without the need to cut or remove any of the seat belts.

14.8.4 Details of the tool referred to above, the belt receptacles and the neck support may be found in the Appendix to these regulations.

ARTICLE 15 : CAR CONSTRUCTION

15.1 Materials :

15.1.1 The use of magnesium sheet less than 3mm thick is forbidden.

15.1.2 No parts of the car may be made from metallic materials which have a specific modulus of elasticity greater than 40 GPa / (g/cm^3). Tests to establish conformity will be carried out in accordance with FIA Test Procedure 03/02, a copy of which may be found in the Appendix to these regulations.

15.2 Roll structures :

15.2.1 All cars must have two roll structures which are designed to help prevent injury to the driver in the event of the car becoming inverted.
The principal structure must be at least 940mm above the reference plane at a point 30mm behind the cockpit entry template. The second structure must be in front of the steering wheel but no more than 250mm forward of the top of the steering wheel rim in any position.
The two roll structures must be of sufficient height to ensure the driver's helmet and his steering wheel are at least 70mm and 50mm respectively below a line drawn between their highest points at all times.

15.2.2 The principal structure must pass a static load test details of which may be found in Article 17.2. Furthermore, each Team must supply detailed calculations which clearly show that it is capable of withstanding the same load when the longitudinal component is applied in a forward direction.

15.2.3 The second structure must pass a static load test details of which may be found in Article 17.3.

15.2.4 Both roll structures must have minimum structural cross sections of 10000mm², in vertical projection, across a horizontal plane 50mm below the their highest points.

15.3 Structure behind the driver :

The parts of the survival cell immediately behind the driver which separate the cockpit from the car's fuel tank, and which lie less than 150mm from the centre line of the car, may be situated no further forward than the line a-b-c-d-e shown in Drawing 2.

15.4 Survival cell specifications :

15.4.1 Every survival cell must incorporate three FIA supplied transponders for identification purposes. These

transponders must be a permanent part of the survival cell, be positioned in accordance with Drawing 6 and must be accessible for verification at any time.

15.4.2 The survival cell must have an opening for the driver, the minimum dimensions of which are given in Article 13.1. Any other openings in the survival cell must be of the minimum size to allow access to mechanical components.

15.4.3 An impact absorbing structure must be fitted in front of the survival cell. This structure need not be an integral part of the survival cell but must be solidly attached to it. Furthermore, it must have a minimum external cross section, in horizontal projection, of 9000mm² at a point 50mm behind its forward-most point.

15.4.4 Referring to Drawing 5 :
The external width of the survival cell between the lines B-B and C-C must be no less than 450mm and must be at least 60mm per side wider than the cockpit opening when measured normal to the inside of the cockpit aperture. These minimum dimensions must be maintained over a height of at least 350mm.
The width of the survival cell may taper forward of the line B-B but, if this is the case, it must do so at a linear rate to a minimum of 300mm at the line A-A.
Between the lines A-A and B-B the width of the survival cell must be greater than the width defined by the two lines a-b. This minimum width must be arranged symmetrically about the car centre line, must be maintained over a height of at least 400mm at the line B-B and may taper at a linear rate to 275mm at the line A-A. When assessing the minimum external cross-sections of the survival cell, radii of 50mm at the line B-B, and reducing at a linear rate to 25mm at the line A-A, will be permitted.
The minimum height of the survival cell between the lines A-A and B-B need not be arranged symmetrically about the horizontal centre line of the relevant section but must be maintained over its entire width.
The minimum height of the survival cell between the lines B-B and C-C is 550mm.

15.4.5 When the test referred to in Article 13.1.1 is carried out and the template is in position with its lower edge 525mm above the reference plane, the shape of the survival cell must be such that no part of it is visible when viewed from either side of the car.
The parts of the survival cell which are situated each side of the driver's helmet must be no more than 550mm apart and, in order to maintain good lateral visibility the driver, when seated normally with his seat belts fastened and looking straight ahead, must have his eyes above the sides of the survival cell.

15.4.6 In order to give additional protection to the driver in the event of a side impact a flat test panel of uniform construction, which is designed and constructed in order to represent a section of the survival cell sides, must pass a strength test. Details of the test procedure may be found in Article 18.6.
Referring to Drawing 5, with the exception of local re-enforcement and/or inserts, all parts of the survival cell which are as wide or wider than the minimum widths stipulated in Article 15.4.4, including any radii applied, must be manufactured to the same specification as a single panel which satisfies the requirements of Article 18.6. Furthermore, parts to this tested specification must cover an area which:

- begins at least 250mm high at line A-A ;
- tapers at a linear rate to at least 400mm high at line B-B and which remains at this height to the rear of the survival cell ;
- is no less than 100mm above the reference plane between the line B-B and the rear of the survival cell.

15.5 Survival cell safety requirements :

15.5.1 The survival cell and frontal absorbing structure must pass an impact test against a solid vertical barrier placed at right angles to the centre line of the car, details of the test procedure may be found in Article 16.2.

15.5.2 Between the front and rear roll structures, on each side of the survival cell, impact absorbing structures must be fitted and must be solidly attached to it. The purpose of these structures is to protect the driver in the event of a lateral impact and, in order to ensure this is the case, a lateral strength test in the vicinity of the driver's seating position must be carried out successfully. Details of the test procedure may be found in Article 18.2.2.
The survival cell and one of these impact absorbing structures must pass an impact test, details of the test procedure may be found in Article 16.3. If these structures are not designed and fitted symmetrically about the car centre line a successful impact test must be carried out on them both.

15.5.3 An impact absorbing structure must be fitted behind the gearbox symmetrically about the car centre line with its rearmost point no less than 480mm behind the rear wheel centre line. It must also have a minimum external cross section, in horizontal projection, of 9000mm² at a point 50mm forward of its rearmost point. When calculating this area only those parts situated less than 100mm from the car centre line may be considered and the cross section may not diminish forward of this point.
This structure must pass an impact test and must be constructed from materials which will not be substantially affected by the temperatures it is likely to be subjected to during use. Details of the test procedure may be found in Article 16.4.

15.5.4 The survival cell must also be subjected to five separate static load tests :

1) on a vertical plane passing through the centre of the fuel tank ;
2) on a vertical plane passing through the rearmost point at which the outer end of the forward-most front wheel tether would make contact with the survival cell when swung about the inner attachment;
3) on a vertical plane 375mm forward of the rear edge of the cockpit entry template ;
4) from beneath the fuel tank ;
5) on each side of the cockpit opening.

Details of the test procedures may be found in Article 18.2.

15.5.5 To test the attachments of the frontal and rear impact absorbing structures static side load tests must be carried out. Details of these test procedures may be found in Articles 18.5 and 18.7.

ARTICLE 16 : IMPACT TESTING

16.1 Conditions applicable to all impact tests :

16.1.1 All tests must be carried out in accordance with FIA Test Procedure 01/00, in the presence of an FIA technical delegate and by using measuring equipment which has been calibrated to the satisfaction of the FIA technical delegate. A copy of the test procedure may be found in the Appendix to these regulations.

16.1.2 Any significant modification introduced into any of the structures tested shall require that part to pass a further test.

16.2 Frontal test :

All parts which could materially affect the outcome of the test must be fitted to the test structure which must be solidly fixed to the trolley through its engine mounting points but not in such a way as to increase its impact resistance.
The fuel tank must be fitted and must be full of water.

A dummy weighing at least 75kg must be fitted with safety belts described in Article 14.4 fastened. However, with the safety belts unfastened, the dummy must be able to move forwards freely in the cockpit.
The extinguishers, as described in Article 14.1 must also be fitted.
For the purposes of this test, the total weight of the trolley and test structure shall be 780kg and the velocity of impact 14.0 metres/sec.
The resistance of the test structure must be such that during the impact :

- the average deceleration over the first 150mm of deformation does not exceed 5g ;
- the average deceleration of the trolley does not exceed 40g ;
- the peak deceleration in the chest of the dummy does not exceed 60g for more than a cumulative 3ms, this being the resultant of data from three axes.

Furthermore, there must be no damage to the survival cell or to the mountings of the safety belts or fire extinguishers.

This test must be carried out on the survival cell subjected to the higher loads in the tests described in Articles 18.2-4, and on a frontal impact absorbing structure identical to the one which was subjected to the test described in Article 18.5.

16.3 Side test :
All parts which could materially affect the outcome of the test must be fitted to the test structure which must be solidly fixed to the ground and a solid object, having a mass of 780kg and travelling at a velocity of 10m/s, will be projected into it.
The object used for this test must :

- incorporate an impactor assembly, the specification of which may be found in the Appendix to these regulations ;
- be positioned in order that its centre of area strikes the structure 300mm (+/-5mm) above the reference plane and at a point 500mm forward of the rear edge of the cockpit opening template.

During the test the striking object may not pivot in any axis and the survival cell may be supported in any way provided this does not increase the impact resistance of the parts being tested. The impact axis must be perpendicular to the car centre line and parallel to the ground.
The resistance of the test structure must be such that during the impact :

- the average deceleration of the object, measured in the direction of impact, does not exceed 20g ;
- the force applied to any one of the four impactor segments does not exceed 80kN for more than a cumulative 3ms ;
- the energy absorbed by each of the four impactor segments must be between 15% and 35% of the total energy absorption.

Furthermore, all structural damage must be contained within the impact absorbing structure.
This test must be carried out on the survival cell subjected to the higher loads in the tests described in Articles 18.2-4.

16.4 Rear test :
All parts which will be fitted behind the rear face of the engine and which could materially affect the outcome of the test must be fitted to the test structure. If suspension members are to be mounted on the structure they must be fitted for the test. The structure and the gearbox must be solidly fixed to the ground and a solid object, having a mass of 780kg and travelling at a velocity of 12m/s, will be projected into it.
The object used for this test must be flat, measure 450mm wide by 550mm high and may have a 10mm radius on all edges. Its lower edge must be at the same level as the car reference plane and must be so arranged to strike the structure vertically and at 90° to the car centre line.
During the test, the striking object may not pivot in any axis and the crash structure may be supported in any way provided this does not increase the impact resistance of the parts being tested.
The resistance of the test structure must be such that during the impact :

- the average deceleration of the object does not exceed 35g ;
- the maximum deceleration does not exceed 60g for more than a cumulative 3ms, this being measured only in the direction of impact

Furthermore, all structural damage must be contained within the area behind the rear wheel centre line.

16.5 Steering column test :
The parts referred to in Article 10.4.4 must be fitted to a representative test structure, any other parts which could materially affect the outcome of the test must also be fitted. The test structure must be solidly fixed to the ground and a solid object, having a mass of 8kg and travelling at a velocity of 7m/s, will be projected into it.
The object used for this test must be hemispherical with a diameter of 165mm.
For the test, the centre of the hemisphere must strike the structure at the centre of the steering wheel along the same axis as the main part of the steering column.
During the test the striking object may not pivot in any axis and the test structure may be supported in any way provided this does not increase the impact resistance of the parts being tested.
The resistance of the test structure must be such that during the impact the peak deceleration of the object does not exceed 80g for more than a cumulative 3ms, this being measured only in the direction of impact.
After the test, all substantial deformation must be within the steering column and the steering wheel quick release mechanism must still function normally.

ARTICLE 17 : ROLL STRUCTURE TESTING

17.1 Conditions applicable to both roll structure tests :
17.1.1 Rubber 3mm thick may be used between the load pads and the roll structure.

17.1.2 Under the load, deformation must be less than 50mm, measured along the loading axis and any structural failure limited to 100mm below the top of the rollover structure when measured vertically.

17.1.3 Any significant modification introduced into any of the structures tested shall require that part to pass a further test.

17.2 Principal roll structure :
A load equivalent to 50kN laterally, 60kN longitudinally in a rearward direction and 90kN vertically, must be applied to the top of the structure through a rigid flat pad which is 200mm in diameter and perpendicular to the loading axis.
During the test, the roll structure must be attached to the survival cell which is supported on its underside on a flat plate, fixed to it through its engine mounting points and wedged laterally by any of the static load test pads described in Article 18.2.

17.3 Second roll structure :
A vertical load of 75kN must be applied to the top of the structure through a rigid flat pad which is 100mm in diameter and perpendicular to the loading axis.
During the test, the rollover structure must be attached to the survival cell which is fixed to a flat horizontal plate.

ARTICLE 18 : STATIC LOAD TESTING

18.1 Conditions applicable to the tests in 18.2-18.5 :
18.1.1 All the following tests must be carried out on the survival cell subjected to the impact tests described in Article 16.

18.1.2 Every subsequent survival cell must also be subjected to all the following tests with peak loads reduced by 20%. During these subsequent tests (on deflections greater than 3.0mm), the deflection across the inner surfaces must not exceed 120% of the deflection obtained at 80% of the peak load during the first test.

18.1.3 Deflections and deformations will be measured at the centre of area of circular load pads and at the top of rectangular pads.

18.1.4 All peak loads must be applied in less than three minutes, through a ball jointed junction at the centre of area of the pad, and maintained for 30 seconds.

18.1.5 In the tests described in 18.2, 18.3 and 18.4, permanent deformation must be less than 1.0mm (0.5mm in 18.3) after the load has been released for 1 minute.

18.1.6 All tests must be carried out by using measuring equipment which has been calibrated to the satisfaction of the FIA technical delegate.

18.1.7 A radius of 3mm is permissible on the edges of all load pads and rubber 3mm thick may be placed between them and the test structure.

18.1.8 For the tests described in 18.2, 18.3 and 18.4, the survival cells must always be produced in an identical condition in order that their weights may be compared. If the weight differs by more than 5% from the one subjected to the impact tests described in Articles 16.2 and 16.3 further frontal and side impact tests and roll structure tests must be carried out.

18.1.9 Any significant modification introduced into any of the structures tested shall require that part to pass a further test.

18.2 Survival cell side tests :

18.2.1 For test 1, referred to in Article 15.5.4, pads 100mm long and 300mm high, which conform to the shape of the survival cell, must be placed against the outermost sides of the survival cell with the lower edge of the pad at the lowest part of the survival cell at that section.
A constant transverse horizontal load of 25.0kN will be applied and, under the load, there must be no structural failure of the inner or outer surfaces of the survival.
On every survival cell tested after that one, the same tests must be carried out but with a load of only 20.0kN. During the tests, on deflections greater than 3.0mm only, the deflection across the inner surfaces must not exceed 120% of the deflection obtained at 20.0kN load during the first test.

18.2.2 For test 2), referred to in Article 15.5.4, pads 200mm in diameter which conform to the shape of the survival cell, must be placed against the outermost sides of the survival cell.
The centre of the pads must pass through the plane mentioned above and the mid point of the height of the structure at that section.

A constant transverse horizontal load of 30.0kN will be applied to the pads and, under the load, there must be no structural failure of the inner or outer surfaces of the survival cell and the total deflection must not exceed 15mm.

18.2.3 For test 3), referred to in Article 15.5.4, pads 200mm in diameter which conform to the shape of the survival cell, must be placed against the outermost sides of the survival cell.
The centre of the pads must be located 350mm above the reference plane and on the vertical plane mentioned in Article 15.5.4.
A constant transverse horizontal load of 30.0kN will be applied to the pads and, under the load, there must be no structural failure of the inner or outer surfaces of the survival cell and the total deflection must not exceed 15mm.

18.3 Fuel tank floor test :

A pad of 200mm diameter must be placed in the centre of area of the fuel tank floor and a vertical upwards load of 12.5kN applied.
Under the load, there must be no structural failure of the inner or outer surfaces of the survival cell.

18.4 Cockpit rim test :

Two pads, each of which is 100mm in diameter, must be placed on both sides of the cockpit rim with their upper edges at the same height as the top of the cockpit side with their centres at a point 200mm forward of the rear edge of the cockpit opening template longitudinally.
A constant transverse horizontal load of 10.0kN will then be applied at 90° to the car centre line and, under the load, there must be no structural failure of the inner or outer surfaces of the survival cell and the total deflection must not exceed 20mm.

18.5 Nose push off test :

During the test the survival cell must be resting on a flat plate and secured to it solidly but not in a way that could increase the strength of the attachments being tested.
A constant transversal horizontal load of 40.0kN must then be applied to one side of the impact absorbing structure, using a pad identical to the ones used in the lateral tests in Article 18.2.1, at a point 550mm from the front wheel axis.
The centre of area of the pad must pass through the plane mentioned above and the mid point of the height of the structure at the relevant section. After 30 seconds of application, there must be no failure of the structure or of any attachment between the structure and the survival cell.

18.6 Side intrusion test

18.6.1 The test must be carried out in accordance with FIA Test Procedure 02/00, in the presence of an FIA technical delegate and by using measuring equipment which has ~~been calibrated to the satisfaction of the FIA technical~~ delegate. **A copy of the test procedure may be found in the Appendix to these regulations.**

18.6.2 The test panel must be 500mm x 500mm and will be tested by forcing a rigid truncated cone through the centre of the panel at a rate of 2mm (+/-1mm) per second until the displacement exceeds 150mm.
During the first 100mm of displacement the load must exceed 150kN and the energy absorption must exceed 6000J. There must be no damage to the fixture or border before these requirements have been met.

18.7 Rear impact structure push off test :

During the test the gearbox and the structure must be solidly fixed to the ground but not in a way that could increase the strength of the attachments being tested.
A constant transversal horizontal load of 40kN must then be applied to one side of the impact absorbing structure, using a pad identical to the ones used in the lateral tests in Article 18.2.1, at a point 300mm from the rear wheel axis.

The centre of area of the pad must pass through the plane mentioned above and the mid point of the height of the structure at the relevant section. After 30 seconds of application, there must be no failure of the structure or of any attachment between the structure and the gearbox.

ARTICLE 19 : FUEL

19.1 Purpose of Article 19 :

19.1.1 The purpose of this Article is to ensure that the fuel used in Formula One is petrol as this term is generally understood.

19.1.2 The detailed requirements of this Article are intended to ensure the use of fuels which are predominantly composed of compounds normally found in commercial fuels and to prohibit the use of specific power-boosting chemical compounds. **Acceptable compounds and compound classes are defined in 19.2 and 19.4.4. In addition, to cover the presence of low level impurities, the sum of components lying outside the**

19.2 and 19.4.4 definitions are limited to 1% max m/m of the total fuel.

19.1.3 Any petrol which appears to have been formulated in order to subvert the purpose of this regulation will be deemed to be outside it.

19.2 Definitions :

Paraffins - straight chain and branched alkanes.

Olefins - straight chain and branched mono-olefins and di-olefins.

- Monocyclic mono-olefins (with five or more carbon atoms in the ring) with or without paraffinic side chains.

Di-olefins - straight chain or branched or monocyclic or bicyclic or tricyclic hydrocarbons (with five or more carbon atoms in any ring) with or without paraffinic side chains, containing two double bonds per molecule.

Naphthenes - monocyclic alkanes (with five or more carbon atoms in the ring) with or without paraffinic side chains.

Aromatics - monocyclic and bicyclic aromatic rings with or without paraffinic or olefinic side chains and/or fused naphthenic rings. Only one double bond may be present outside the aromatic ring. Fused naphthenic rings must meet the naphthene definition above.

Oxygenates - specified organic compounds containing oxygen.

19.3 Properties :

The only fuel permitted is petrol having the following characteristics:

Property	Units	Min	Max	Test Method
RON		95.0	102.0	ASTM D 2699-86
MON		85.0		ASTM D 2700-86
Oxygen	%m/m		2.7	Elemental Analysis
Nitrogen	%m/m		0.2	ASTM D 3228
Benzene	%v/v		1.0	EN 238
RVP	hPa	450	600	ASTM D 323
Lead	g/l		0.005	ASTM D 3237
Density at 15°C	kg/m³	720.0	775.0	ASTM D 4052
Oxidation stability	minutes	360		ASTM D 525
Existent gum	mg/100ml		5.0	EN 26246
Sulphur	mg/kg		50	EN-ISO/DIS 14596
Copper corrosion	rating		C1	ISO 2160
Electrical Conductivity	pS/m	200		ASTM D 2624

Distillation characteristics :

At E70°C	%v/v	20.0	48.0	ISO 3405
At E100°C	%v/v	46.0	71.0	ISO 3405
At E150°C	%v/v	75.0		ISO 3405
Final Boiling Point	°C		210	ISO 3405
Residue	%v/v		2.0	ISO 3405

The fuel will be accepted or rejected according to ASTM D 3244 with a confidence limit of 95%

19.4 Composition of the fuel :

19.4.1 The composition of the petrol must comply with the detailed below:

	Units	Min	Max	Test Method
Aromatics	%v/v	0*	35*	ASTM D 1319
Olefins	%v/v	0	18*	ASTM D 1319
Total di-olefins	%m/m	0	1	GCMS
Total styrene and alkyl derivatives	%m/m		1	GCMS

*Values when corrected for fuel oxygenate content.

In addition, the fuel must contain no substance which is capable of exothermic reaction in the absence of external oxygen.

19.4.2 The total of individual hydrocarbon components present at concentrations of less than 5%m/m must be at least 30% m/m of the fuel.

19.4.3 The total concentration of each hydrocarbon group in the total fuel sample (defined by carbon number and hydrocarbon type), must not exceed the limits given in the table below:

% m/m	C4	C5	C6	C7	C8	C9+	Non PONA*	Unassigned
Paraffins	10	30	25	25	55	20	-	
Naphtenes	-	5	10	10	10	10	-	
Olefins	5	20	20	15	10	10	-	
Aromatics	-	-	1,2	35	35	30	-	
Maximum	15	40	45	50	60	45	1	5

* Non PONA are components not meeting definitions in 19.2 and 19.4.4

For the purposes of this table, a gas chromatographic technique must be employed which can classify hydrocarbons in the total fuel sample such that all those identified are allocated to the appropriate cell of the table. Compounds present at concentrations below 0.1% by mass may be deemed unassigned, except that it is the responsibility of the fuel approval laboratory to ensure that components representing at least 95% by mass of the total fuel are assigned.

which cannot be allocated to a particular cell may be ignored.

The sum of the non PONA and unassigned hydrocarbons must not exceed 5.0% by mass of the total fuel sample.

19.4.4 The only oxygenates permitted are :

Methanol (MeOH)
Ethanol (EtOH)
Iso-propyl alcohol (IPA)
Iso-butyl alcohol (IBA)
Methyl Tertiary Butyl Ether (MTBE)
Ethyl Tertiary Butyl Ether (ETBE)
Tertiary Amyl Methyl Ether (TAME)
Di-Isopropyl Ether (DIPE)
n-Propyl alcohol (NPA)
Tertiary Butyl Alcohol (TBA)
n-Butyl Alcohol (NBA)
Secondary Butyl Alcohol (SBA)

Compounds normally found as impurities in any of the above oxygenates are permitted at concentrations below 0.8% m/m of the total petrol sample.

19.4.5 Manganese based additives are not permitted

19.5 Air :

Only ambient air may be mixed with the fuel as an oxidant.

19.6 Safety :

19.6.1 Manganese based additives are not permitted.

19.6.2 All competitors must be in possession of a Material Safety Data Sheet for each type of petrol used. This sheet must be made out in accordance with EC Directive 93/112/EEC and all information contained therein strictly adhered to.

19.7 Fuel approval :

19.7.1 Before any fuel may be used in an Event, two separate five litre samples, in suitable containers, must be submitted to the FIA for analysis and approval.

19.7.2 No fuel may be used in an Event without prior written approval of the FIA.

19.8 Sampling and testing at an Event:

19.8.1 All samples will be taken in accordance with FIA Formula One fuel sampling procedure, a copy of which may be found in the Appendix to these regulations.

19.8.2 Fuel samples taken during an Event will be checked for conformity by using densitometry and a gas chromatographic technique which will compare the sample taken with an approved fuel. Samples, which differ from the approved fuel in a manner consistent with evaporative loss, will be considered to conform. However, the FIA retains the right to subject the fuel sample to further testing at an FIA approved laboratory.

19.8.3 GC peak areas of the sample will be compared with those obtained from the reference fuel. Increases in any given peak area (relative to its adjacent peak areas) which are greater than 12%, or an absolute amount greater than 0.1% for compounds present at concentrations below 0.8%, will be deemed not to comply.

If a peak is detected in a fuel sample that was absent in the corresponding reference fuel, and its peak area represents more than 0.10% of the summed peak areas of the fuel, the fuel will be deemed not to comply.

19.9 Amendments to Article 19 :

19.9.1 The physical and compositional properties of the fuel described in 19.3 and 19.4 incorporate the currently known limits for 2000, as laid out in European Fuels Directive 98/70/EC (13 October 1998).

19.9.2 When the Final Directive, as defined by the FIA, is adopted for 2005 (or such other date as the Directive may specify), the new values will replace those being used in 19.3 and 19.4 no later than one year after the figures are known.

ARTICLE 20 : TELEVISION CAMERAS

20.1 Presence of cameras and camera housings :

All cars must be fitted with either two cameras, two camera housings or one of each at all times throughout the Event.

20.2 Location of camera housings :

Camera housings, when used, must be fitted in the same location as cameras. Details concerning the size and weight of all camera housings may be found in the Appendix to these regulations.

20.3 Location and fitting of camera equipment :

20.3.1 All cars must be equipped with five positions in which cameras or camera housings can be fitted. Referring to Drawing 6, all cars must carry a camera or camera housing in position 4, the position of the remaining camera or camera housing will be determined by the FIA after consultation with the relevant Competitor.
Once positions are determined in the above manner, any decision as to whether a camera or camera housing is fitted in those positions will rest solely with the relevant Competitor.

20.3.2 Any camera or dummy camera fitted in positions 1, 2 or 3 shown in Drawing 6 must be mounted in order that its major axis does not subtend an angle greater than 5° to the reference plane.

20.4 Transponders :

All cars must be fitted with a timing transponder supplied by the officially appointed timekeepers. This transponder must be fitted in strict accordance with the instructions detailed in the Appendix to these regulations.

ARTICLE 21 : FINAL TEXT

The final text for these regulations shall be the English version should any dispute arise over their interpretation.

ARTICLE 22 : CHANGES FOR 2004

22.1 Amendments to Article 11.4 :

11.4 Air ducts:

Air ducts for the purpose of cooling the front and rear brakes shall not protrude beyond :

- a plane parallel to the ground situated at a distance of 160mm above the horizontal centre line of the wheel ;
- a plane parallel to the ground situated at a distance of 160mm below the horizontal centre line of the wheel ;
- a vertical plane parallel to the inner face of the wheel rim and displaced from it by 120mm toward the centre line of the car.

Furthermore, when viewed from the side the ducts must not protrude forwards beyond the periphery of the tyre or backwards beyond the wheel rim.

22.2 Amendments to Article 19.3

19.3 Properties:

The only fuel permitted is petrol having the following characteristics:

Property	Units	Min	Max	Test Method
RON		95.0	102.0	ASTM D 2699-86
MON		85.0		ASTM D 2700-86
Oxygen	%m/m		2.7	Elemental Analysis
Nitrogen	mg/kg		500	ASTM D 4629
Benzene	%v/v		1.0	EN 238
RVP	hPa	450	600	ASTM D 323
Lead	g/l		0.005	ASTM D 3237
Density at 15°C	kg/m³	720.0	775.0	ASTM D 4052
Oxidation Stability	minutes	360		ASTM D 525
Existent gum	mg/100ml		5.0	EN 26246
Sulphur	mg/kg		10	ASTM D 5453
Copper corrosion	rating		C1	ISO 2160
Electrical conductivity	pS/m	200		ASTM D 2624
Distillation characteristics:				
At E70°C	%v/v	20.0	48.0	ISO 3405
At E100°C	%v/v	46.0	71.0	ISO 3405
At E150°C	%v/v	75.0		ISO 3405
Final Boiling Point	°C		210	ISO 3405
Residue	%v/v		2.0	ISO 3405

The fuel will be accepted or rejected according to ASTM D 3244 with a confidence limit of 95%.

ARTICLE 23 : CHANGES FOR 2005

22.1 Amendments to Article 6.2.1 :

6.2.1 All apertures in the fuel tank must be closed by hatches or fittings which are secured to metallic or composite bolt rings bonded to the inside of the bladder. The total area of any such hatches or fittings which are in contact with the fuel may not exceed 30000mm².
Bolt hole edges must be no less than 5mm from the edge of the bolt ring, hatch or fitting.

22.2 Amendments to Article 17.1 :

17.1 Conditions applicable to both roll structure tests :

17.1.1 Rubber 3mm thick may be used between the load pads and the roll structure.

17.1.2 Both peak loads must be applied in less than three minutes and be maintained for 10 seconds.

17.1.3 Under the load, deformation must be less than 50mm, measured along the loading axis and any structural failure limited to 100mm below the top of the rollover structure when measured vertically.

17.1.4 Any significant modification introduced into any of the structures tested shall require that part to pass a further test.

23.3 Amendments to Article 18.6 :

18.6 Side intrusion test

18.6.1 The test must be carried out in accordance with FIA Test Procedure 02/00, in the presence of an FIA technical delegate and by using measuring equipment which has been calibrated to the satisfaction of the FIA technical delegate.

18.6.2 The test panel must be **600mm x 600mm** and will be tested by forcing a rigid truncated cone through the centre of the panel at a rate of 2mm (+/-1mm) per second until the displacement exceeds 150mm.
During the first 100mm of displacement the load must exceed **200kN**, the energy absorption must exceed **8000J and** there must be no damage to the fixture before these requirements have been met.

EXHIBIT C

2004 FORMULA ONE TECHNICAL REGULATIONS

SUMMARY

ARTICLE 1: DEFINITIONS

1.1 Formula One Car :
An automobile designed solely for speed races on circuits or closed courses.

1.2 Automobile :
A land vehicle running on at least four non-aligned complete wheels, of which at least two are used for steering and at least two for propulsion.

1.3 Land vehicle :
A locomotive device propelled by its own means, moving by constantly taking real support on the earth's surface, of which the propulsion and steering are under the control of a driver aboard the vehicle.

1.4 Bodywork :
All entirely sprung parts of the car in contact with the external air stream, except cameras and the parts definitely associated with the mechanical functioning of the engine, transmission and running gear. Airboxes, radiators and engine exhausts are considered to be part of the bodywork.

1.5 Wheel :
Flange and rim.

1.6 Complete wheel :
Wheel and inflated tyre. The complete wheel is considered part of the suspension system.

1.7 Automobile Make :
In the case of Formula racing cars, an automobile make is a complete car. When the car manufacturer fits an engine which it does not manufacture, the car shall be considered a hybrid and the name of the engine manufacturer shall be associated with that of the car manufacturer. The name of the car manufacturer must always precede that of the engine manufacturer. Should a hybrid car win a Championship Title, Cup or Trophy, this will be awarded to the manufacturer of the car.

1.8 Event :
An event shall consist of official practice and the race.

1.9 Weight :
Is the weight of the car with the driver, wearing his complete racing apparel, at all times during the event.

1.10 Racing weight :
Is the weight of the car in running order with the driver aboard and all fuel tanks full.

1.11 Cubic capacity :
The volume swept in the cylinders of the engine by the movement of the pistons. This volume shall be expressed in cubic centimetres. In calculating engine cubic capacity, the number Pi shall be 3.1416.

1.12 Supercharging :
Increasing the weight of the charge of the fuel/air mixture in the combustion chamber (over the weight induced by normal atmospheric pressure, ram effect and dynamic effects in the intake and/or exhaust system) by any means whatsoever. The injection of fuel under pressure is not considered to be supercharging.

1.13 Cockpit :
The volume which accommodates the driver.

1.14 Sprung suspension :
The means whereby all complete wheels are suspended from the body/chassis unit by a spring medium.

1.15 Survival cell :
A continuous closed structure containing the fuel tank and the cockpit.

1.16 Camera :
Television cameras the dimensions of which are defined in Drawing 6.

1.17 Camera housing :
A device which is identical in shape and weight to a camera and which is supplied by the relevant Competitor for fitting to his car in lieu of a camera.

1.18 Cockpit padding :
Non-structural parts placed within the cockpit for the sole purpose of improving driver comfort and safety. All such material must be quickly removable without the use of tools.

1.19 Brake caliper :
All parts of the braking system outside the survival cell, other than brake discs, brake pads, caliper pistons, brake hoses and fittings, which are stressed when subjected to the braking pressure. Bolts or studs which are used for attachment are not considered to be part of the braking system.

1.20 Electronically controlled :
Any command system or process that utilises semi-conductor or thermionic technology.

ARTICLE 2 : GENERAL PRINCIPLES

2.1 Role of the FIA :
The following technical regulations for Formula 1 cars are issued by the FIA.

2.2 Amendments to the regulations :
Amendments to these regulations will be made in accordance with the Concorde agreement.

2.3 Dangerous construction :
The stewards of the meeting may exclude a vehicle whose construction is deemed to be dangerous.

2.4 Compliance with the regulations :
Automobiles must comply with these regulations in their entirety at all times during an Event.
Should a competitor feel that any aspect of these regulations is unclear, clarification may be sought from the FIA Formula One Technical Department. If clarification relates to any new design or system, correspondence must include :

- a full description of the design or system ;
- drawings or schematics where appropriate ;
- the Competitor's opinion concerning the immediate implications on other parts of the car of any proposed new design ;
- the Competitor's opinion concerning any possible long term consequences or new developments which may come from using any such new designs or systems ;
- the precise way or ways in which the Competitor feels the new design or system will enhance the performance of the car.

2.5 Measurements :
All measurements must be made while the car is stationary on a flat horizontal surface.

2.6 Duty of Competitor :
It is the duty of each Competitor to satisfy the FIA technical delegate and the Stewards of the Meeting that his automobile complies with these regulations in their entirety at all times during an Event.
The design of the car, it's components and systems shall, with the exception of safety features, demonstrate their compliance with these regulations by means of physical inspection of hardware or materials. No mechanical design may rely upon software inspection as a means of ensuring its compliance.

ARTICLE 3 : BODYWORK AND DIMENSIONS

For illustrations refer to drawings 1A-5A in the Appendix to these regulations

3.1 Wheel centre line :

The centre line of any wheel shall be deemed to be half way between two straight edges, perpendicular to the surface on which the car is standing, placed against opposite sides of the complete wheel at the centre of the tyre tread.

3.2 Height measurements :
All height measurements will be taken normal to and from the reference plane.

3.3 Overall width :
The overall width of the car, including complete wheels, must not exceed 1800mm with the steered wheels in the straight ahead position. Overall width will be measured when the car is fitted with tyres inflated to 1.4 bar.

3.4 Width ahead of the rear wheel centre line :

3.4.1 Bodywork width ahead of the rear wheel centre line must not exceed 1400mm.

3.4.2 In order to prevent tyre damage to other cars, the top and forward edges of the lateral extremities of any bodywork forward of the front wheels must be at least 10mm thick with a radius of at least 5mm.

3.5 Width behind the rear wheel centre line :
Bodywork width behind the rear wheel centre line must not exceed 1000mm.

3.6 Overall height :
No part of the bodywork may be more than 950mm above the reference plane.

3.7 Front bodywork height :
All bodywork situated forward of a point lying 330mm behind the front wheel centre line, and more than 250mm from the centre line of the car, must be no less than 100mm and no more than 300mm above the reference plane.

3.8 Height in front of the rear wheels :

3.8.1 Other than the rear view mirrors, each with a maximum area in plan view of 12000mm², no bodywork situated more than 330mm behind the front wheel centre line and more than 330mm forward of the rear wheel centre line, which is more than 600mm above the reference plane, may be more than 300mm from the centre line of the car.

3.8.2 No bodywork between the rear wheel centre line and a line 800mm forward of the rear wheel centre line, which is more than 500mm from the centre line of the car, may be more than 500mm above the reference plane.

3.8.3 No bodywork between the rear wheel centre line and a line 400mm forward of the rear wheel centre line, which is more than 500mm from the centre line of the car, may be more than 300mm above the reference plane.

3.9 Bodywork between the rear wheels :

3.9.1 No bodywork more than 100 mm from the car centre line, and which is situated between the rear wheel centre line and a point lying 330mm forward of it may be more than 600mm above the reference plane.

3.9.2 No bodywork more than 50 mm from the car centre line, and which is situated between the rear wheel centre line and a point lying 150mm behind it may be more than 450mm above the reference plane.

3.10 Height behind the rear wheel centre line :

3.10.1 Any part of the car more than 150mm behind the centre line of the rear wheels must not be more than 800mm above the reference plane.

3.10.2 No bodywork behind the centre line of the rear wheels, and more than 150mm each side of the longitudinal centre line of the car, may be less than 300mm above the reference plane.

3.10.3 Any bodywork more than 150mm behind the rear wheel centre line which is more than 300mm above the reference plane, and between 75mm and 480mm from the car centre line, must lie in one of two areas when viewed from the side of the car :
The lower area is situated from 300mm to 375mm above the reference plane, and from 150mm to 500mm behind the rear wheel centre line. When viewed from the side of the car, no longitudinal cross section may have more than one closed section in the lower area.

The upper area is situated from 600mm to 800mm above the reference plane, and from 150mm to 500mm behind the rear wheel centre line. When viewed from the side of the car, no longitudinal cross section may have more than two closed sections in the upper area. Furthermore, the distance between adjacent sections at any longitudinal plane must not exceed 15mm at their closest position.

In side view, the projected area of the bodywork lying between 300mm and 800mm above the reference plane, and 150mm and 600mm behind the rear wheel centre line must be greater than 200 000 mm².

3.11 Bodywork around the front wheels :
With the exception of brake cooling ducts, in plan view, there must be no bodywork in the area formed by two longitudinal lines parallel to and 400mm and 900mm from the car centre line and two transversal lines, one 350mm forward of and one 800mm behind the front wheel centre line.

3.12 Bodywork facing the ground :

3.12.1 All sprung parts of the car situated more than 330mm behind the front wheel centre line and more than 330mm forward of the rear wheel centre line, and which are visible from underneath, must form surfaces which lie on one of two parallel planes, the reference plane or the step plane. This does not apply to any parts of rear view mirrors which are visible, provided each of these areas does not exceed 12000mm² when projected to a horizontal plane above the car. The step plane must be 50mm above the reference plane.

3.12.2 Additionally, the surface formed by all parts lying on the reference plane must :
- extend from a point lying 330mm behind the front wheel centre line to the centre line of the rear wheels;
- have minimum and maximum widths of 300mm and 500mm respectively ;
- be symmetrical about the centre line of the car ;
- have a 50mm radius (+/-2mm) on each front corner when viewed from directly beneath the car, this being applied after the surface has been defined.

3.12.3 The surface lying on the reference plane must be joined around its periphery to the surfaces lying on the step plane by a vertical transition. If there is no surface visible on the step plane vertically above any point around the periphery of the reference plane, this transition is not necessary.

3.12.4 The peripheries of the surfaces lying on the reference and step planes may be curved upwards with maximum radii of 25 and 50mm respectively. Where the vertical transition meets the surfaces on the step plane a radius, no greater than 25mm, is permitted.

A radius in this context will be considered as an arc applied perpendicular to the periphery and tangential to both surfaces.

The surface lying on the reference plane, the surfaces lying on the step plane, the vertical transitions between them and any surfaces rearward of the surfaces lying on the reference or step planes, must first be fully defined before any radius can be applied or the skid block fitted. Any radius applied is still considered part of the relevant surface.

3.12.5 All parts lying on the reference and step planes, in addition to the transition between the two planes, must produce uniform, solid, hard, continuous, rigid (no degree of freedom in relation to the body/chassis unit), impervious surfaces under all circumstances.

Fully enclosed holes are permitted in the surfaces lying on the reference and step planes provided no part of the car is visible through them when viewed from directly below.

3.12.6 To help overcome any possible manufacturing problems, and not to permit any design which may contravene any part of these regulations, dimensional tolerances are permitted on bodywork situated between a point lying 330mm behind the front wheel centre line and the rear wheel centre line. A vertical tolerance of +/- 5mm is permissible across the surfaces lying on the reference and step planes and a horizontal tolerance of 5mm is permitted when assessing whether a surface is visible from beneath the car.

3.12.7 All sprung parts of the car situated behind a point lying 330mm forward of the rear wheel centre line, which are visible from underneath and are more than 250mm from the centre line of the car, must be at least 50mm above the reference plane.

3.13 Skid block :

3.13.1 Beneath the surface formed by all parts lying on the reference plane, a rectangular skid block, with a 50mm radius (+/-2mm) on each front corner, must be fitted. This skid block may comprise more than one piece but must :

a) extend longitudinally from a point lying 330mm behind the front wheel centre line to the centre line of the rear wheels.
b) be made from an homogeneous material with a specific gravity between 1.3 and 1.45.
c) have a width of 300mm with a tolerance of +/- 2mm.
d) have a thickness of 10mm with a tolerance of +/- 1mm.
e) have a uniform thickness when new.
f) have no holes or cut outs other than those necessary to fit the fasteners permitted by 3.13.2 or those holes specifically mentioned in g) below.
g) have seven precisely placed holes the positions of which are detailed in Drawing 1. In order to establish the conformity of the skid block after use, it's thickness will only be measured in the four 50mm diameter holes and the two forward 80mm diameter holes.
Four further 10 mm diameter holes are permitted provided their sole purpose is to allow access to the bolts which secure the Accident Data Recorder to the survival cell.
h) be fixed symmetrically about the centre line of the car in such a way that no air may pass between it and the surface formed by the parts lying on the reference plane.

3.13.2 Fasteners used to attach the skid block to the car must :

a) have a total area no greater than 40000mm² when viewed from directly beneath the car ;

b) be no greater than 2000mm² in area individually when viewed from directly beneath the car ;
c) be fitted in order that their entire lower surfaces are visible from directly beneath the car.
When the skid block is new, ten of the fasteners may be flush with it's lower surface but the remainder may be no more than 8mm below the reference plane.

3.13.3 The lower edge of the periphery of the skid block may be chamfered at an angle of 30° to a depth of 8mm, the trailing edge however may be chamfered over a distance of 200mm to a depth of 8mm.

3.14 Overhangs :

No part of the car may be more than 600mm behind the centre line of the rear wheels or more than 1200mm in front of the centre line of the front wheels.
No part of the car less than 480mm from the centre line of the car may be more than 500mm behind the centre line of the rear wheels.
No part of the bodywork more than 200mm from the centre line of the car may be more than 900mm in front of the front wheel centre line.
All overhang measurements will be taken parallel to the reference plane.

3.15 Aerodynamic influence :

Any specific part of the car influencing its aerodynamic performance (with the exception of the cover described in Article 6.5.2 in the pit lane only) :

- Must comply with the rules relating to bodywork.
- Must be rigidly secured to the entirely sprung part of the car (rigidly secured means not having any degree of freedom).
- Must remain immobile in relation to the sprung part of the car.

Any device or construction that is designed to bridge the gap between the sprung part of the car and the ground is prohibited under all circumstances.
No part having an aerodynamic influence and no part of the bodywork, with the exception of the skid block in 3.13 above, may under any circumstances be located below the reference plane.

3.16 Upper bodywork :

3.16.1 With the exception of the opening described in Article 3.16.3, when viewed from the side, the car must have bodywork in the area bounded by four lines. One vertical 1330 mm forward of the rear wheel centre line, one horizontal 550 mm above the reference plane, one horizontal 925 mm above the reference plane and one diagonal which intersects the 925 mm horizontal at a point 1000mm forward of the rear wheel centreline and the 550mm horizontal at the rear wheel centreline
Bodywork within this area must be arranged symmetrically about the car centre line and, when measured 200mm vertically below the diagonal boundary line, must have minimum widths of 150mm and 50mm respectively at points lying 1000mm forward of the rear wheel centre line and at the rear wheel centre line. This bodywork must lie on or outside the boundary defined by a linear taper between these minimum widths.

3.16.2 Bodywork lying vertically above the upper boundary as defined in 3.16.1 may be no wider than 125mm and must be arranged symmetrically about the car centreline.

3.16.3 In order that a car may be lifted quickly in the event of it stopping on the circuit, the principal rollover structure must incorporate a clearly visible unobstructed opening designed to permit a strap, whose section measures 60mm x 30mm, to pass through it.

3.17 Bodywork flexibility :

3.17.1 Bodywork may deflect no more than 5mm vertically when a 500N load is applied vertically to it 700mm forward of the front wheel centre line and 625mm from the car centre line. The load will be applied in a

downward direction using a 50mm diameter ram and an adapter 300mm long and 150mm wide. Teams must supply the latter when such a test is deemed necessary.

3.17.2 Bodywork may deflect no more than 10mm vertically when a 500N load is applied vertically to it 400mm forward of the rear wheel centre line and 650mm from the car centre line. The load will be applied in a downward direction using a 50mm diameter ram and an adapter of the same size, Teams must supply the latter when such a test is deemed necessary.

3.17.3 Bodywork may deflect by no more than one degree horizontally when a load of 1000N is applied simultaneously to its extremities in a rearward direction 780mm above the reference plane and 130mm behind the rear wheel centre line.

3.17.4 In order to ensure that the requirements of Article 3.15 are respected, the FIA reserves the right to introduce further load/deflection tests on any part of the bodywork which appears to be (or is suspected of), moving whilst the car is in motion.

ARTICLE 4 : WEIGHT

4.1 Minimum weight :
The weight of the car must not be less than 605 kg during the qualifying practice session and no less than 600 kg at all other times during the Event.

4.2 Ballast :
Ballast can be used provided it is secured in such a way that tools are required for its removal. It must be possible to fix seals if deemed necessary by the FIA technical delegate.

4.3 Adding during the race :
With the exception of fuel and compressed gases, no substance may be added to the car during the race. If it becomes necessary to replace any part of the car during the race, the new part must not weigh any more than the original part.

ARTICLE 5 : ENGINE

5.1 Engine specification :

5.1.1 Only 4-stroke engines with reciprocating pistons are permitted.

5.1.2 Engine capacity must not exceed 3000 cc.

5.1.3 Supercharging is forbidden.

5.1.4 All engines must have 10 cylinders and the normal section of each cylinder must be circular.

5.1.5 Engines may have no more than 5 valves per cylinder.

5.2 Other means of propulsion :

5.2.1 The use of any device, other than the 3 litre, four stroke engine described in 5.1 above, to power the car, is not permitted.

5.2.2 The total amount of recoverable energy stored on the car must not exceed 300kJ, any which may be recovered at a rate greater than 2kW must not exceed 20kJ.

5.3 Engine intake air :

5.3.1 Other than injection of fuel for the normal purpose of combustion in the engine, any device, system, procedure, construction or design the purpose or effect of which is any decrease in the temperature of the engine intake air is forbidden.

5.3.2 Other than engine sump breather gases and fuel for the normal purpose of combustion in the engine, the spraying of any substance into the engine intake air is forbidden.

5.4 Exhaust system :
Variable geometric length exhaust systems are forbidden.

5.5 Engine materials :

5.5.1 The basic structure of the crankshaft and camshafts must be made from steel or cast iron.

5.5.2 Pistons, cylinder heads and cylinder blocks may not be composite structures which use carbon or aramid fibre reinforcing materials.

5.6 Starting the engine :
A supplementary device temporarily connected to the car may be used to start the engine both on the grid and in the pits.

5.7 Stall prevention systems :
If a car is equipped with a stall prevention system, and in order to avoid the possibility of a car involved in an accident being left with the engine running, all such systems must be configured to stop the engine no more than ten seconds after activation.

ARTICLE 6 : FUEL SYSTEM

6.1 Fuel tanks :

6.1.1 The fuel tank must be a single rubber bladder conforming to or exceeding the specifications of FIA/FT5-1999, the fitting of foam within the tank however is not mandatory. A list of approved materials may be found in the Appendix to these regulations.

6.1.2 All the fuel stored on board the car must be situated between the front face of the engine and the driver's back when viewed in lateral projection. When establishing the front face of the engine, no parts of the fuel, oil, water or electrical systems will be considered. Furthermore, no fuel can be stored more than 300mm forward of the highest point at which the driver's back makes contact with his seat. However, a maximum of 2 litres of fuel may be kept outside the survival cell, but only that which is necessary for the normal running of the engine.

6.1.3 Fuel must not be stored more than 400mm from the longitudinal axis of the car.

6.1.4 All rubber bladders must be made by manufacturers recognised by the FIA. In order to obtain the agreement of the FIA, the manufacturer must prove the compliance of his product with the specifications approved by the FIA. These manufacturers must undertake to deliver to their customers exclusively tanks complying to the approved standards.
A list of approved manufacturers may be found in the Appendix to these regulations.

6.1.5 All rubber bladders shall be printed with the name of the manufacturer, the specifications to which the tank has been manufactured and the date of manufacture.

6.1.6 No rubber bladders shall be used more than 5 years after the date of manufacture.

6.2 Fittings and piping :

6.2.1 All apertures in the fuel tank must be closed by hatches or fittings which are secured to metallic or composite bolt rings bonded to the inside of the bladder.
Bolt hole edges must be no less than 5mm from the edge of the bolt ring, hatch or fitting.

6.2.2 All fuel lines between the fuel tank and the engine must have a self sealing breakaway valve. This valve must separate at less than 50% of the load required to break the fuel line fitting or to pull it out of the fuel tank.

6.2.3 No lines containing fuel may pass through the cockpit.

6.2.4 All lines must be fitted in such a way that any leakage cannot result in the accumulation of fuel in the cockpit.

6.3 Crushable structure :
The fuel tank must be completely surrounded by a crushable structure, which is an integral part of the survival cell and must be able to withstand the loads required by the tests in Articles 18.2.1 and 18.3.

6.4 Fuel tank fillers :
Fuel tank fillers must not protrude beyond the bodywork. Any breather pipe connecting the fuel tank to the atmosphere must be designed to avoid liquid leakage when the car is running and its outlet must not be less than 250mm from the cockpit opening. All fuel tank fillers and breathers must be designed to ensure an efficient locking action which reduces the risk of an accidental opening following a crash impact or incomplete locking after refuelling.

6.5 Refuelling :

6.5.1 All refuelling during the race must be carried out at a rate no greater than 12.1 litres per second and by using equipment which has been supplied by the FIA designated manufacturer, details concerning the manufacturer may be found in the Appendix to these regulations. This manufacturer will be required to supply identical refuelling systems, the complete specification of which will be available from the FIA no later than one month prior to the first Championship Event.
Any modifications to the manufacturer's specification may only be made following written consent from the FIA.

6.5.2 A cover must be fitted over the car connector at all times when the car is running on the track. The cover and it's attachments must be sufficiently strong to avoid accidental opening in the event of an accident.

6.5.3 Before refuelling commences, the car connector must be connected electrically to earth.
All metal parts of the refuelling system from the coupling to the supply tank must also be connected to earth.

6.5.4 Refuelling the car on the grid may only be carried out by using an unpressurised container which is no more than 2 metres above the ground.

6.5.5 No fuel on board the car may be more than ten degrees centigrade below ambient temperature.

6.5.6 The use of any device on board the car to decrease the temperature of the fuel is forbidden.

6.6 Fuel sampling :

6.6.1 Competitors must ensure that a one litre sample of fuel may be taken from the car at any time during the Event.

6.6.2 All cars must be fitted with a –2 'Symetrics' male fitting in order to facilitate fuel sampling. If an electric pump on board the car cannot be used to remove the fuel an externally connected one may be used provided it is evident that a representative fuel sample is being taken. If an external pump is used it must be possible to connect the FIA sampling hose to it and any hose between the car and pump must be -3 in diameter and not exceed 2m in length. Details of the fuel sampling hose may be found in the Appendix to these regulations.

6.6.3 The sampling procedure must not necessitate starting the engine or the removal of bodywork (other than the cover over the refuelling connector).

ARTICLE 7 : OIL AND COOLANT SYSTEMS

7.1 Location of oil tanks :
All oil storage tanks must be situated between the front wheel axis and the rearmost gearbox casing longitudinally, and must be no further than the lateral extremities of the survival cell are from the longitudinal axis of the car.

7.2 Longitudinal location of oil system :
No other part of the car containing oil may be situated behind the complete rear wheels.

7.3 Catch tank :
In order to avoid the possibility of oil being deposited on the track, the engine sump breather must vent into the main engine air intake system.

7.4 Transversal location of oil system :
No part of the car containing oil may be more than 700mm from the longitudinal centre line of the car.

7.5 Coolant header tank :
The coolant header tank on the car must be fitted with an FIA approved pressure relief valve which is set to a maximum of 3.75 bar gauge pressure, details of the relief valve may be found in the Appendix to these regulations. If the car is not fitted with a header tank, an alternative position must be approved by the FIA.

7.6 Cooling systems :
The cooling systems of the engine must not intentionally make use of the latent heat of vaporisation of any fluid.

7.7 Oil and coolant lines :

7.7.1 No lines containing coolant or lubricating oil may pass through the cockpit.

7.7.2 All lines must be fitted in such a way that any leakage cannot result in the accumulation of fluid in the cockpit.

7.7.3 No hydraulic fluid lines may have removable connectors inside the cockpit.

ARTICLE 8 : ELECTRICAL SYSTEMS

8.1 Software and electronics inspection :

8.1.1 Prior to the start of each season the complete electrical system on the car must be examined and all on board and communications software must be inspected by the FIA Technical Department.
The FIA must be notified of any changes prior to the Event at which such changes are intended to be implemented.

8.1.2 All re-programmable microprocessors must have a mechanism that allows the FIA to accurately identify the software version loaded.

8.1.3 All electronic units containing a programmable device, and which are intended for use at an Event, must be presented to the FIA before each Event in order that they can be identified.

8.1.4 All on-car software versions must be registered with the FIA before use.

8.1.5 The FIA must be able to test the operation of any compulsory electronic safety systems at any time during an Event.

8.2 Start systems :

8.2.1 Any system, the purpose and/or effect of which is to detect when a race start signal is given, is not permitted.

8.2.2 Whichever driver input device is used to initiate the propulsion of the car during the start of a race, a verifiable signal must be provided which indicates it's instant of operation.

8.3 Accident data recorders :
The recorder must be fitted and operated :

- by being rigidly attached to the survival cell using the four 7mm diameter holes provided ;
- in accordance with the instructions of the FIA ;
- symmetrically about the car centre line and with its top facing upwards ;
- with each of its 12 edges parallel to an axis of the car ;
- less than 50mm above the reference plane ;
- in a position which is normally accessible at the start and finish of an Event ;
- in order that the entire unit lies between 40% and 60% of the wheelbase of the car ;
- with its main connector facing forwards ;
- in order that its status light is visible when the driver is in the cockpit ;
- in order that the download connector is easily accessible without the need to remove bodywork.

8.4 Marshal information display :
All cars must be fitted with red, blue and yellow cockpit lights the purpose of which are to give drivers information concerning track signals or conditions. The lights must be LEDs each with a minimum diameter of 5mm and which are fitted in order that they are directly in the driver's normal line of sight. Details of the light control system, which must be fitted to every car, may be found in the Appendix to these regulations.

ARTICLE 9 : TRANSMISSION SYSTEM

9.1 Transmission types :
No transmission system may permit more than two wheels to be driven.

9.2 Clutch control :
All cars must be fitted with a means of disengaging the clutch for a minimum of fifteen minutes in the event of the car coming to rest with the engine stopped. This system must be in working order throughout the Event even if the main hydraulic, pneumatic or electrical systems on the car have failed.
In order that the driver or a marshal may activate the system in less than five seconds, the switch or button which operates it must :

- face upwards and be positioned on the survival cell no more than 150mm from the car centre line ;
- be designed in order that a marshal is unable to accidentally re-engage the clutch ;
- be less than 150mm from the front of the cockpit opening ;
- be marked with a letter "N" in red inside a white circle of at least 50mm diameter with a red edge.

9.3 Gear ratios :
9.3.1 The minimum number of forward gear ratios is 4 and the maximum is 7.

9.3.2 Continuously variable transmission systems are not permitted.

9.4 Reverse gear :
All cars must have a reverse gear operable any time during the Event by the driver when the engine is running.

9.5 Torque transfer systems :
Any system or device the design of which is capable of transferring or diverting torque from a slower to a faster rotating wheel is not permitted.

ARTICLE 10 : SUSPENSION AND STEERING SYSTEMS

10.1 Sprung suspension :
Cars must be fitted with sprung suspension. The springing medium must not consist solely of bolts located through flexible bushes or mountings.
There must be movement of the wheels to give suspension travel in excess of any flexibility in the attachments.
The suspension system must be so arranged that its response is consistent at all times and results only from changes in vertical load applied to the wheels save only for movement permitted by inherent and fixed physical properties.

10.2 Suspension geometry :
10.2.1 Suspension geometry must remain fixed at all times.

10.2.2 Any powered device which is capable of altering the configuration or affecting the performance of any part of the suspension system is forbidden.

10.2.3 No adjustment may be made to the suspension system while the car is in motion.

10.3 Suspension members :
10.3.1 The cross-sections of each member of every suspension component must have an aspect ratio no greater than 3.5:1 and be symmetrical about its major axis. All suspension components may however have sections with an aspect ratio greater than 3.5:1, and be non-symmetrical, provided these are adjacent to their inner and outer attachments and form no more than 25% of the total distance between the attachments of the relevant member.
All measurements will be made perpendicular to a line drawn between the inner and outer attachments of the relevant member.

10.3.2 No major axis of a cross section of a suspension member may subtend an angle greater than 5° to the reference plane when measured parallel to the centre line of the car.

10.3.3 Non-structural parts of suspension members are considered bodywork.

10.3.4 In order to help prevent a wheel becoming separated in the event of all suspension members connecting it to the car failing, two cables, each with separate attachments, must be fitted to connect each wheel/upright assembly to the main structure of the car. The cables and their attachments must be designed in order to help prevent a wheel making contact with the driver's head during an accident.
The length of each cable should be no longer than that required to allow normal suspension movement.
Each complete cable restraint system, including their attachments, must :

- have a minimum tensile strength of 70kN ;
- utilise flexible cables each with a diameter greater than 9.5 mm

Each cable must also be capable of absorbing more than 900 J.
However, when fitted to a car utilising a survival cell the type of which was used at an Event during the 2003 Championship season, the tensile strength of the inner and outer attachments may comply with the 2003 Technical Regulations.

10.4 Steering :
10.4.1 Any steering system which permits the re-alignment of more than two wheels is not permitted.

10.4.2 Power assisted steering systems may not be electronically controlled or electrically powered. No such system may carry out any function other than reduce the physical effort required to steer the car.

10.4.3 No part of the steering wheel or column, nor any part fitted to them, may be closer to the driver than a plane formed by the entire rear edge of the steering wheel rim.

10.4.4 The steering wheel, steering column and steering rack assembly must pass an impact test, details of the test procedure may be found in Article 16.5.

ARTICLE 11 : BRAKE SYSTEM

11.1 Brake circuits and pressure distribution :

11.1.1 All cars must be equipped with only one brake system. This system must comprise solely of two separate hydraulic circuits operated by one pedal, one circuit operating on the two front wheels and the other on the two rear wheels. This system must be designed so that if a failure occurs in one circuit the pedal will still operate the brakes in the other.

11.1.2 The brake system must be designed in order that the force exerted on the brake pads within each circuit are the same at all times.

11.1.3 Any powered device which is capable of altering the configuration or affecting the performance of any part of the brake system is forbidden.

11.1.4 Any change to, or modulation of, the brake system whilst the car is moving must be made by the drivers direct physical input, may not be pre-set and must be under his complete control at all times.

11.2 Brake calipers :

11.2.1 All brake calipers must be made from aluminium materials with a modulus of elasticity no greater than 80Gpa.

11.2.2 No more than two attachments may be used to secure each brake caliper to the car.

11.2.3 No more than one caliper, with a maximum of six pistons, is permitted on each wheel.

11.2.4 The section of each caliper piston must be circular.

11.3 Brake discs :

11.3.1 No more than one brake disc is permitted on each wheel.

11.3.2 All discs must have a maximum thickness of 28mm and a maximum outside diameter of 278mm.

11.3.3 No more than two brake pads are permitted on each wheel.

11.4 Air ducts :

Air ducts for the purpose of cooling the front and rear brakes shall not protrude beyond :

- a plane parallel to the ground situated at a distance of 160mm above the horizontal centre line of the wheel ;
- a plane parallel to the ground situated at a distance of 160mm below the horizontal centre line of the wheel ;
- a vertical plane parallel to the inner face of the wheel rim and displaced from it by 120mm toward the centre line of the car.

Furthermore, when viewed from the side the ducts must not protrude forwards beyond the periphery of the tyre or backwards beyond the wheel rim.

11.5 Brake pressure modulation :

11.5.1 No braking system may be designed to prevent wheels from locking when the driver applies pressure to the brake pedal.

11.5.2 No braking system may be designed to increase the pressure in the brake calipers above that achievable by the driver applying pressure to the pedal under static conditions.

11.6 Liquid cooling :

Liquid cooling of the brakes is forbidden.

ARTICLE 12 : WHEELS AND TYRES

12.1 Location :

Wheels must be external to the bodywork in plan view, with the rear aerodynamic device removed.

12.2 Number of wheels :

The number of wheels is fixed at four.

12.3 Wheel material :

All wheels must be made from an homogeneous metallic material.

12.4 Wheel dimensions :

12.4.1 Complete wheel width must lie between 305 and 355mm when fitted to the front of the car and between 365 and 380mm when fitted to the rear.

12.4.2 Complete wheel diameter must not exceed 660mm when fitted with dry-weather tyres or 670mm when fitted with wet-weather tyres.

12.4.3 Complete wheel width and diameter will be measured horizontally at axle height when fitted with new tyres inflated to 1.4 bar.

12.4.4 Wheel bead diameter must lie between 328 and 332mm.

ARTICLE 13 : COCKPIT

13.1 Cockpit opening :

13.1.1 In order to ensure that the opening giving access to the cockpit is of adequate size, the template shown in Drawing 2 will be inserted into the survival cell and bodywork.
During this test the steering wheel, steering column, seat and all padding required by Articles 14.6.1-6 (including fixings), may be removed and :

- the template must be held horizontal and lowered vertically from above the car until its lower edge is 525mm above the reference plane ;
- referring to Drawing 2, the edge of the template which lies on the line d-e must be no less than 1800mm behind the line A-A shown in Drawing 5.

Any measurements made from the cockpit entry template (when referred to in Articles 13.1.3, 14.3.3, 15.2.2, 15.4.5, 15.4.6, 15.5.4, 16.3 and 18.4), must also be made whilst the template is held in this position.

13.1.2 The forward extremity of the cockpit opening, even if structural and part of the survival cell, must be at least 50mm in front of the steering wheel.

13.1.3 The driver must be able to enter and get out of the cockpit without it being necessary to open a door or remove any part of the car other than the steering wheel. When seated normally, the driver must be facing forwards and the rearmost part of his crash helmet may be no more than 125mm forward of the rear edge of the cockpit entry template.

13.1.4 From his normal seating position, with all seat belts fastened and whilst wearing his usual driving equipment, the driver must be able to remove the steering wheel and get out of the car within 5 seconds and then replace the steering wheel in a total of 10 seconds.

For this test, the position of the steered wheels will be determined by the FIA technical delegate and after the steering wheel has been replaced steering control must be maintained.

13.2 Steering wheel :

The steering wheel must be fitted with a quick release mechanism operated by pulling a concentric flange installed on the steering column behind the wheel.

13.3 Internal cross section :

13.3.1 A free vertical cross section, which allows the outer template shown in Drawing 3 to be passed vertically through the cockpit to a point 100mm behind the face of the rearmost pedal when in the inoperative position, must be maintained over its entire length.

The only things which may encroach on this area are the steering wheel and any padding that is required by Article 14.6.7.

13.3.2 A free vertical cross section, which allows the inner template shown in Drawing 3 to be passed vertically through the cockpit to a point 100mm behind the face of rearmost pedal when in the inoperative position, must be maintained over its entire length.
The only thing which may encroach on this area is the steering wheel.

13.3.3 The driver, seated normally with his seat belts fastened and with the steering wheel removed must be able to raise both legs together so that his knees are past the plane of the steering wheel in the rearward direction. This action must not be prevented by any part of the car.

13.4 Position of the driver's feet :

13.4.1 The survival cell must extend from behind the fuel tank in a rearward direction to a point at least 300mm in front of the driver's feet, with his feet resting on the pedals and the pedals in the inoperative position.

13.4.2 When he is seated normally, the soles of the driver's feet, resting on the pedals in the inoperative position, must not be situated forward of the front wheel centre line.

ARTICLE 14 : SAFETY EQUIPMENT

14.1 Fire extinguishers :

14.1.1 All cars must be fitted with a fire extinguishing system which will discharge into the cockpit and into the engine compartment.

14.1.2 Any extinguishant listed in the Appendix to the regulations is permitted.

14.1.3 The quantity of extinguishant may vary according to the type of extinguishant used, a list of quantities may be found in the Appendix to these regulations.

14.1.4 When operated, the fire extinguishing system must discharge 95% of its contents at a constant pressure in no less than 10 seconds and no more than 30 seconds.
If more than one container with extinguishant is fitted, they must be released simultaneously.

14.1.5 Each pressure vessel must be equipped with a means of checking its pressure which may vary according to the type of extinguishant used. A list of pressures may be found in the Appendix to the regulations.

14.1.6 The following information must be visible on each container with extinguishant :

a) Type of extinguishant
b) Weight or volume of the extinguishant
c) Date the container must be checked which must be no more than two years after the date of filling.

14.1.7 All parts of the extinguishing system must be situated within the survival cell and all extinguishing equipment must withstand fire.

14.1.8 Any triggering system having its own source of energy is permitted, provided it is possible to operate all extinguishers should the main electrical circuits of the car fail.
The driver must be able to trigger the extinguishing system manually when seated normally with his safety belts fastened and the steering wheel in place.
Furthermore, a means of triggering from the outside must be combined with the circuit breaker switch described in Article 14.2.2. It must be marked with a letter "E" in red inside a white circle of at least 100mm diameter with a red edge.

14.1.9 The system must work in any position, even when the car is inverted.

14.1.10 All extinguisher nozzles must be suitable for the extinguishant and be installed in such a way that they are not directly pointed at the driver.

14.2 Master switch :

14.2.1 The driver, when seated normally with the safety belts fastened and the steering wheel in place, must be able to cut off the electrical circuits to the ignition, all fuel pumps and the rear light by means of a spark proof circuit breaker switch.
This switch must be located on the dashboard and must be clearly marked by a symbol showing a red spark in a white edged blue triangle.

14.2.2 There must also be an exterior switch, with a horizontal handle, which is capable of being operated from a distance by a hook. This switch must be situated at the base of the main roll over structure on the right hand side.

14.3 Rear view mirrors :

14.3.1 All cars must have at least two mirrors mounted so that the driver has visibility to the rear and both sides of the car.

14.3.2 The reflective surface of each mirror must be at least 150mm wide, this being maintained over a height of at least 50mm. Additionally, each corner may have a radius no greater than 10mm.

14.3.3 No part of the reflective surface may be less than 250mm from the car centre line or more than 750mm from the rear of the cockpit entry template.

14.3.4 The FIA technical delegate must be satisfied by a practical demonstration that the driver, when seated normally, can clearly define following vehicles.
For this purpose, the driver shall be required to identify any letter or number, 150mm high and 100mm wide, placed anywhere on boards behind the car, the positions of which are detailed below :

Height	:	From 400mm to 1000mm from the ground.
Width	:	2000mm either side of the centre line of the car.
Position	:	10m behind the rear axle line of the car.

14.4 Safety belts :

It is mandatory to wear two shoulder straps, one abdominal strap and two straps between the legs. These straps must be securely fixed to the car and must comply with FIA standard 8853/98.

14.5 Rear light :

All cars must have a red light in working order throughout the Event which :

- has been manufactured as specified in the Appendix to these regulations ;
- faces rearwards at 90° to the car centre line and the reference plane ;
- is clearly visible from the rear ;
- is not mounted more than 100mm from the car centre line ;
- is mounted between 325mm and 400mm above the reference plane ;
- is no less than 450mm behind the rear wheel centre line measured parallel to the reference plane ;
- can be switched on by the driver when seated normally in the car.

The three measurements above will be taken to the centre of the rear face of the light unit.

14.6 Headrests and head protection :

14.6.1 All cars must be equipped with three areas of padding for the driver's head which :

- are so arranged that they can be removed from the car as one part ;

- are located by two horizontal pegs behind the driver' head and two fixings, which are clearly indicated and easily removable without tools, at the front corners ;
- are made from a material which is suitable for the relevant ambient air temperature, details of approved materials and the temperature bands in which they should be used may be found in the Appendix to these regulations ;
- are covered, in all areas where the driver's head is likely to make contact, with two plies of Aramid fibre/epoxy resin composite pre-preg material in plain weave 60gsm fabric with a cured resin content of 50% (+/-5%) by weight ;
- are positioned so as to be the first point of contact for the driver's helmet in the event of an impact projecting his head towards them during an accident.

14.6.2 The first area of padding for the driver's head must be positioned behind him and be between 75mm and 90mm thick over an area of at least 40000mm².

14.6.3 The two further areas of padding for the driver's head must be positioned directly alongside each side of his helmet. The upper surfaces of these areas of padding must be at least as high as the survival cell over their entire length.
Each area of padding must be between 75mm and 90mm thick over an area of at least 25000mm² and may have a radius of 10mm along it's upper inboard edge. When calculating their area, any part which is greater than 75mm thick and which lies between the front face of the rear area of padding and the forward most part of the driver's helmet whilst he is seated normally, will be taken into account (area 'B' in Drawing 4). The thickness will be measured perpendicular to the car centre line.

14.6.4 Forward of the side areas of padding further cockpit padding must be provided on each side of the cockpit rim. The purpose of the additional padding is to afford protection to the driver's head in the event of an oblique frontal impact and must therefore be made from the same material as the other three areas of padding.

These extensions must :
- be symmetrically positioned about the car centre line and a continuation of the side areas of padding ;
- be positioned with their upper surfaces at least as high as the survival cell over their entire length;
- have a radius on their upper inboard edge no greater than 10mm ;
- be positioned in order that the distance between the two is no less than 360mm ;
- be as high as practicable within the constraints of driver comfort.

14.6.5 All of the padding described above must be so installed that if movement of the driver's head, in any expected trajectory during an accident, were to compress the foam fully at any point, his helmet would not make contact with any structural part of the car.
Furthermore, for the benefit of rescue crews all of the padding described above must be installed using the system described in the Appendix to these regulations. The method of removal must also be clearly indicated.

14.6.6 No part of the padding described above may obscure sight of any part of the driver's helmet when he is seated normally and viewed from directly above the car.

14.6.7 In order to minimise the risk of leg injury during an accident, additional areas of padding must be fitted each side of, and above, the driver's legs.

These areas of padding must :
- be made from a material described in the Appendix to these regulations ;
- be no less than 25mm thick over their entire area ;
- cover the area situated between points lying 50mm behind the centre of the point at which the second roll structure test is carried out and100mm behind the face of the rearmost pedal when in the inoperative position, as shown in Drawing 4 ;
- cover the area above the line A-A shown in Drawing 3.

14.7 Wheel retention :
All cars, whilst under their own power, must be fitted with devices which will retain any wheel in the event of it coming loose.
After the wheel nut is fastened, these devices must be manually fitted in a separate action to that of securing the wheel nut.

14.8 Seat fixing and removal :

14.8.1 In order that an injured driver may be removed from the car in his seat following an accident, all cars must be fitted with a seat which, if it is secured, must be done so with no more than two bolts. If bolts are used they must :
- be clearly indicated and easily accessible to rescue crews ;
- be fitted vertically ;
- be removable with the same tool for all Teams and which is issued to all rescue crews.

14.8.2 The seat must be equipped with receptacles which permit the fitting of belts to secure the driver and one which will permit the fitting of a neck support.

14.8.3 The seat must be removable without the need to cut or remove any of the seat belts.

14.8.4 Details of the tool referred to above, the belt receptacles and the neck support may be found in the Appendix to these regulations.

14.9 Head and neck supports :
No head and neck support worn by the driver may be less 25mm from any structural part of the car when he is seated in his normal driving position.

ARTICLE 15 : CAR CONSTRUCTION

15.1 Materials :

15.1.1 The use of magnesium sheet less than 3mm thick is forbidden.

15.1.2 No parts of the car may be made from metallic materials which have a specific modulus of elasticity greater than 40 GPa / (g/cm^3). Tests to establish conformity will be carried out in accordance with FIA Test Procedure 03/02, a copy of which may be found in the Appendix to these regulations.

15.2 Roll structures :

15.2.1 All cars must have two roll structures which are designed to help prevent injury to the driver in the event of the car becoming inverted.
The principal structure must be at least 940mm above the reference plane at a point 30mm behind the cockpit entry template. The second structure must be in front of the steering wheel but no more than 250mm forward of the top of the steering wheel rim in any position.
The two roll structures must be of sufficient height to ensure the driver's helmet and his steering wheel are at least 70mm and 50mm respectively below a line drawn between their highest points at all times.

15.2.2 The principal structure must pass a static load test details of which may be found in Article 17.2. Furthermore, each Team must supply detailed calculations which clearly show that it is capable of withstanding the same load when the longitudinal component is applied in a forward direction.

15.2.3 The second structure must pass a static load test details of which may be found in Article 17.3.

15.2.4 Both roll structures must have minimum structural cross sections of 10000mm², in vertical projection, across a horizontal plane 50mm below the their highest points.

15.3 Structure behind the driver :

The parts of the survival cell immediately behind the driver which separate the cockpit from the car's fuel tank, and which lie less than 150mm from the centre line of the car, may be situated no further forward than the line a-b-c-d-e shown in Drawing 2.

15.4 Survival cell specifications :

15.4.1 Every survival cell must incorporate three FIA supplied transponders for identification purposes. These transponders must be a permanent part of the survival cell, be positioned in accordance with Drawing 6 and must be accessible for verification at any time.

15.4.2 The survival cell must have an opening for the driver, the minimum dimensions of which are given in Article 13.1. Any other openings in the survival cell must be of the minimum size to allow access to mechanical components.

15.4.3 An impact absorbing structure must be fitted in front of the survival cell. This structure need not be an integral part of the survival cell but must be solidly attached to it. Furthermore, it must have a minimum external cross section, in horizontal projection, of 9000mm² at a point 50mm behind its forward-most point.

15.4.4 Referring to Drawing 5 :
The external width of the survival cell between the lines B-B and C-C must be no less than 450mm and must be at least 60mm per side wider than the cockpit opening when measured normal to the inside of the cockpit aperture. These minimum dimensions must be maintained over a height of at least 350mm.
The width of the survival cell may taper forward of the line B-B but, if this is the case, it must do so at a linear rate to a minimum of 300mm at the line A-A.
Between the lines A-A and B-B the width of the survival cell must be greater than the width defined by the two lines a-b. This minimum width must be arranged symmetrically about the car centre line, must be maintained over a height of at least 400mm at the line B-B and may taper at a linear rate to 275mm at the line A-A. When assessing the minimum external cross-sections of the survival cell, radii of 50mm at the line B-B, and reducing at a linear rate to 25mm at the line A-A, will be permitted.
The minimum height of the survival cell between the lines A-A and B-B need not be arranged symmetrically about the horizontal centre line of the relevant section but must be maintained over its entire width.
The minimum height of the survival cell between the lines B-B and C-C is 550mm.

15.4.5 When the test referred to in Article 13.1.1 is carried out and the template is in position with its lower edge 525mm above the reference plane, the shape of the survival cell must be such that no part of it is visible when viewed from either side of the car.
The parts of the survival cell which are situated each side of the driver's helmet must be no more than 550mm apart and, in order to maintain good lateral visibility the driver, when seated normally with his seat belts fastened and looking straight ahead, must have his eyes above the sides of the survival cell.

15.4.6 In order to give additional protection to the driver in the event of a side impact a flat test panel of uniform construction, which is designed and constructed in order to represent a section of the survival cell sides, must pass a strength test. Details of the test procedure may be found in Article 18.6.
Referring to Drawing 5, with the exception of local re-enforcement and/or inserts, all parts of the survival cell which are as wide or wider than the minimum widths stipulated in Article 15.4.4, including any radii applied, must be manufactured to the same specification as a single panel which satisfies the requirements of Article 18.6. Furthermore, parts to this tested specification must cover an area which:

- begins at least 250mm high at line A-A ;
- tapers at a linear rate to at least 400mm high at line B-B and which remains at this height to the rear of the survival cell ;
- is no less than 100mm above the reference plane between the line B-B and the rear of the survival cell.

15.5 Survival cell safety requirements :

15.5.1 The survival cell and frontal absorbing structure must pass an impact test against a solid vertical barrier placed at right angles to the centre line of the car, details of the test procedure may be found in Article 16.2.

15.5.2 Between the front and rear roll structures, on each side of the survival cell, impact absorbing structures must be fitted and must be solidly attached to it. The purpose of these structures is to protect the driver in the event of a lateral impact and, in order to ensure this is the case, a lateral strength test in the vicinity of the driver's seating position must be carried out successfully. Details of the test procedure may be found in Article 18.2.2.
The survival cell and one of these impact absorbing structures must pass an impact test, details of the test procedure may be found in Article 16.3. If these structures are not designed and fitted symmetrically about the car centre line a successful impact test must be carried out on them both.

15.5.3 An impact absorbing structure must be fitted behind the gearbox symmetrically about the car centre line with its rearmost point no less than 480mm behind the rear wheel centre line. It must also have a minimum external cross section, in horizontal projection, of 9000mm² at a point 50mm forward of its rearmost point. When calculating this area only those parts situated less than 100mm from the car centre line may be considered and the cross section may not diminish forward of this point.
This structure must pass an impact test and must be constructed from materials which will not be substantially affected by the temperatures it is likely to be subjected to during use. Details of the test procedure may be found in Article 16.4.

15.5.4 The survival cell must also be subjected to five separate static load tests :

1) on a vertical plane passing through the centre of the fuel tank ;
2) on a vertical plane passing through the rearmost point at which the outer end of the forward-most front wheel tether would make contact with the survival cell when swung about the inner attachment;
3) on a vertical plane 375mm forward of the rear edge of the cockpit entry template ;
4) from beneath the fuel tank ;
5) on each side of the cockpit opening.

Details of the test procedures may be found in Article 18.2.

15.5.5 To test the attachments of the frontal and rear impact absorbing structures static side load tests must be carried out on the same structures which will subsequently undergo the impact tests described in Articles 16.2 and 16.4. Details of these test procedures may be found in Articles 18.5 and 18.7.

ARTICLE 16 : IMPACT TESTING

16.1 Conditions applicable to all impact tests :

16.1.1 All tests must be carried out in accordance with FIA Test Procedure 01/00, in the presence of an FIA technical

delegate and by using measuring equipment which has been calibrated to the satisfaction of the FIA technical delegate. A copy of the test procedure may be found in the Appendix to these regulations.

16.1.2 Any significant modification introduced into any of the structures tested shall require that part to pass a further test.

16.1.3 The reference survival cell must have passed every static load test described in Articles 15.2, 15.5.4 and 15.5.5 before being subjected to any impact test.

16.2 Frontal test :
All parts which could materially affect the outcome of the test must be fitted to the test structure which must be solidly fixed to the trolley through its engine mounting points but not in such a way as to increase its impact resistance.
The fuel tank must be fitted and must be full of water.
A dummy weighing at least 75kg must be fitted with safety belts described in Article 14.4 fastened. However, with the safety belts unfastened, the dummy must be able to move forwards freely in the cockpit.
The extinguishers, as described in Article 14.1 must also be fitted.
For the purposes of this test, the total weight of the trolley and test structure shall be 780kg and the velocity of impact 14.0 metres/sec.

The resistance of the test structure must be such that during the impact :
- the average deceleration over the first 150mm of deformation does not exceed 5g ;
- the average deceleration of the trolley does not exceed 40g ;

- the peak deceleration in the chest of the dummy does not exceed 60g for more than a cumulative 3ms, this being the resultant of data from three axes.

Furthermore, there must be no damage to the survival cell or to the mountings of the safety belts or fire extinguishers.

This test must be carried out on the survival cell subjected to the higher loads in the tests described in Articles 18.2-4, and on the frontal impact absorbing structure identical to the one which was subjected to the test described in Article 18.5.

16.3 Side test :
All parts which could materially affect the outcome of the test must be fitted to the test structure which must be solidly fixed to the ground and a solid object, having a mass of 780kg and travelling at a velocity of 10m/s, will be projected into it.
The object used for this test must :
- incorporate an impactor assembly, the specification of which may be found in the Appendix to these regulations ;
- be positioned in order that its centre of area strikes the structure 300mm (+/-25mm) above the reference plane and at a point 500mm forward of the rear edge of the cockpit opening template.

During the test the striking object may not pivot in any axis and the survival cell may be supported in any way provided this does not increase the impact resistance of the parts being tested. The impact axis must be perpendicular to the car centre line and parallel to the ground.
The resistance of the test structure must be such that during the impact :
- the average deceleration of the object, measured in the direction of impact, does not exceed 20g ;
- the force applied to any one of the four impactor segments does not exceed 80kN for more than a cumulative 3ms ;
- the energy absorbed by each of the four impactor segments must be between 15% and 35% of the total energy absorption.

Furthermore, all structural damage must be contained within the impact absorbing structure.
This test must be carried out on the survival cell subjected to the higher loads in the tests described in Articles 18.2-4.

16.4 Rear test :
All parts which will be fitted behind the rear face of the engine and which could materially affect the outcome of the test must be fitted to the test structure. If suspension members are to be mounted on the structure they must be fitted for the test. The structure and the gearbox must be solidly fixed to the ground and a solid object, having a mass of 780kg and travelling at a velocity of 12m/s, will be projected into it.
The object used for this test must be flat, measure 450mm wide by 550mm high and may have a 10mm radius on all edges. Its lower edge must be at the same level as the car reference plane and must be so arranged to strike the structure vertically and at 90° to the car centre line.
During the test, the striking object may not pivot in any axis and the crash structure may be supported in any way provided this does not increase the impact resistance of the parts being tested.
The resistance of the test structure must be such that during the impact :
- the average deceleration of the object does not exceed 35g ;
- the maximum deceleration does not exceed 60g for more than a cumulative 3ms, this being measured only in the direction of impact

Furthermore, all structural damage must be contained within the area behind the rear wheel centre line.

This test must be carried out on the rear impact absorbing structure which was subjected to the test described in Article 18.7.

16.5 Steering column test :
The parts referred to in Article 10.4.4 must be fitted to a representative test structure, any other parts which could materially affect the outcome of the test must also be fitted. The test structure must be solidly fixed to the ground and a solid object, having a mass of 8kg and travelling at a velocity of 7m/s, will be projected into it.
The object used for this test must be hemispherical with a diameter of 165mm.
For the test, the centre of the hemisphere must strike the structure at the centre of the steering wheel along the same axis as the main part of the steering column.
During the test the striking object may not pivot in any axis and the test structure may be supported in any way provided this does not increase the impact resistance of the parts being tested.
The resistance of the test structure must be such that during the impact the peak deceleration of the object does not exceed 80g for more than a cumulative 3ms, this being measured only in the direction of impact.
After the test, all substantial deformation must be within the steering column and the steering wheel quick release mechanism must still function normally.

ARTICLE 17 : ROLL STRUCTURE TESTING

17.1 Conditions applicable to both roll structure tests :
17.1.1 Rubber 3mm thick may be used between the load pads and the roll structure.

17.1.2 Under the load, deformation must be less than 50mm, measured along the loading axis and any structural failure limited to 100mm below the top of the rollover structure when measured vertically.

17.1.3 Any significant modification introduced into any of the structures tested shall require that part to pass a further test.

17.2 Principal roll structure :
A load equivalent to 50kN laterally, 60kN longitudinally in a rearward direction and 90kN vertically, must be applied to the top of the structure through a rigid flat pad which is 200mm in diameter and perpendicular to the loading axis.
During the test, the roll structure must be attached to the survival cell which is supported on its underside on a flat plate, fixed to it through its engine mounting points and wedged laterally by any of the static load test pads described in Article 18.2.

17.3 Second roll structure :
A vertical load of 75kN must be applied to the top of the structure through a rigid flat pad which is 100mm in diameter and perpendicular to the loading axis.
During the test, the rollover structure must be attached to the survival cell which is fixed to a flat horizontal plate.

ARTICLE 18 : STATIC LOAD TESTING

18.1 Conditions applicable to the tests in 18.2-18.5 :

18.1.1 The tests described in Articles 18.2, 18.3, 18.4 and 18.5 must be carried out on the survival cell which will be subjected to the impact tests described in Article 16.

18.1.2 Every subsequent survival cell produced must also be subjected to the tests described in Articles 18.2, 18.3 and 18.4.
However, the tests described in Articles 18.2.1, 18.3 and 18.4 may be carried out on subsequent survival cells with peak loads reduced by 20%. During these subsequent tests (on deflections greater than 3.0mm), the deflection across the inner surfaces must not exceed 120% of the deflection obtained at 80% of the peak load during the first test.

18.1.3 Deflections and deformations will be measured at the centre of area of circular load pads and at the top of rectangular pads.

18.1.4 All peak loads must be applied in less than three minutes, through a ball jointed junction at the centre of area of the pad, and maintained for 30 seconds.

18.1.5 Following the tests described in 18.2, 18.3 and 18.4, permanent deformation must be less than 1.0mm (0.5mm in 18.3) after the load has been released for 1 minute.

18.1.6 All tests must be carried out by using measuring equipment which has been calibrated to the satisfaction of the FIA technical delegate.

18.1.7 A radius of 3mm is permissible on the edges of all load pads and rubber 3mm thick may be placed between them and the test structure.

18.1.8 For the tests described in 18.2, 18.3 and 18.4, the survival cells must always be produced in an identical condition in order that their weights may be compared. If the weight differs by more than 5% from the one subjected to the impact tests described in Articles 16.2 and 16.3 further frontal and side impact tests and roll structure tests must be carried out.

18.1.9 Any significant modification introduced into any of the structures tested shall require that part to pass a further test.

18.2 Survival cell side tests :

18.2.1 For test 1, referred to in Article 15.5.4, pads 100mm long and 300mm high, which conform to the shape of the survival cell, must be placed against the outermost sides of the survival cell with the lower edge of the pad at the lowest part of the survival cell at that section.
A constant transverse horizontal load of 25.0kN will be applied and, under the load, there must be no structural failure of the inner or outer surfaces of the survival.

18.2.2 For test 2), referred to in Article 15.5.4, pads 200mm in diameter which conform to the shape of the survival cell, must be placed against the outermost sides of the survival cell.
The centre of the pads must pass through the plane mentioned above and the mid point of the height of the structure at that section.
A constant transverse horizontal load of 30.0kN will be applied to the pads and, under the load, there must be no structural failure of the inner or outer surfaces of the survival cell and the total deflection must not exceed 15mm.

18.2.3 For test 3), referred to in Article 15.5.4, pads 200mm in diameter which conform to the shape of the survival cell, must be placed against the outermost sides of the survival cell.
The centre of the pads must be located 350mm above the reference plane and on the vertical plane mentioned in Article 15.5.4.
A constant transverse horizontal load of 30.0kN will be applied to the pads and, under the load, there must be no structural failure of the inner or outer surfaces of the survival cell and the total deflection must not exceed 15mm.

18.3 Fuel tank floor test :
A pad of 200mm diameter must be placed in the centre of area of the fuel tank floor and a vertical upwards load of 12.5kN applied.
Under the load, there must be no structural failure of the inner or outer surfaces of the survival cell.

18.4 Cockpit rim test :
Two pads, each of which is 100mm in diameter, must be placed on both sides of the cockpit rim with their upper edges at the same height as the top of the cockpit side with their centres at a point 200mm forward of the rear edge of the cockpit opening template longitudinally.
A constant transverse horizontal load of 10.0kN will then be applied at 90° to the car centre line and, under the load, there must be no structural failure of the inner or outer surfaces of the survival cell and the total deflection must not exceed 20mm.

18.5 Nose push off test :
During the test the survival cell must be resting on a flat plate and secured to it solidly but not in a way that could increase the strength of the attachments being tested.
A constant transversal horizontal load of 40.0kN must then be applied to one side of the impact absorbing structure, using a pad identical to the ones used in the lateral tests in Article 18.2.1, at a point 550mm from the front wheel axis.
The centre of area of the pad must pass through the plane mentioned above and the mid point of the height of the structure at the relevant section. After 30 seconds of application, there must be no failure of the structure or of any attachment between the structure and the survival cell.

18.6 Side intrusion test

18.6.1 The test must be carried out in accordance with FIA Test Procedure 02/00, in the presence of an FIA technical delegate and by using measuring equipment which has been calibrated to the satisfaction of the FIA technical delegate. A copy of the test procedure may be found in the Appendix to these regulations.

18.6.2 The test panel must be 500mm x 500mm and will be tested by forcing a rigid truncated cone through the centre of the panel at a rate of 2mm (+/-1mm) per second until the displacement exceeds 150mm.
During the first 100mm of displacement the load must exceed 150kN and the energy absorption must exceed 6000J. There must be no damage to the fixture or border before these requirements have been met.

18.7 Rear impact structure push off test :
During the test the gearbox and the structure must be solidly fixed to the ground but not in a way that could increase the strength of the attachments being tested.
A constant transversal horizontal load of 40kN must then be applied to one side of the impact absorbing structure, using a pad identical to the ones used in the lateral tests in Article 18.2.1, at a point 300mm from the rear wheel axis.

The centre of area of the pad must pass through the plane mentioned above and the mid point of the height of the structure at the relevant section. After 30 seconds of application, there must be no failure of the structure or of any attachment between the structure and the gearbox.

ARTICLE 19 : FUEL

19.1 Purpose of Article 19 :

19.1.1 The purpose of this Article is to ensure that the fuel used in Formula One is petrol as this term is generally understood.

19.1.2 The detailed requirements of this Article are intended to ensure the use of fuels which are predominantly composed of compounds normally found in commercial fuels and to prohibit the use of specific power-boosting chemical compounds. Acceptable compounds and compound classes are defined in 19.2 and 19.4.4. In addition, to cover the presence of low level impurities, the sum of components lying outside the 19.2 and 19.4.4 definitions are limited to 1% max m/m of the total fuel.

19.1.3 Any petrol which appears to have been formulated in order to subvert the purpose of this regulation will be deemed to be outside it.

19.2 Definitions :

Paraffins - straight chain and branched alkanes.

Olefins - straight chain and branched mono-olefins and di-olefins.
- Monocyclic mono-olefins (with five or more carbon atoms in the ring) with or without paraffinic side chains.

Di-olefins - straight chain or branched or monocyclic or bicyclic or tricyclic hydrocarbons (with five or more carbon atoms in any ring) with or without paraffinic side chains, containing two double bonds per molecule.

Naphthenes - monocyclic alkanes (with five or more carbon atoms in the ring) with or without paraffinic side chains.

Aromatics - monocyclic and bicyclic aromatic rings with or without paraffinic or olefinic side chains and/or fused naphthenic rings. Only one double bond may be present outside the aromatic ring. Fused naphthenic rings must meet the naphthene definition above.

Oxygenates - specified organic compounds containing oxygen.

19.3 Properties :

The only fuel permitted is petrol having the following characteristics:

Property	Units	Min	Max	Test Method
RON		95.0	102.0	ASTM D 2699-86
MON		85.0		ASTM D 2700-86
Oxygen	%m/m		2.7	Elemental Analysis
Nitrogen	%m/m		0.2	ASTM D 3228
Benzene	%v/v		1.0	EN 238
RVP	hPa	450	600	ASTM D 323
Lead	g/l		0.005	ASTM D 3237
Density at 15°C	kg/m³	720.0	775.0	ASTM D 4052
Oxidation stability	minutes	360		ASTM D 525
Existent gum	mg/100ml		5.0	EN 26246
Sulphur	mg/kg		10	EN-ISO/DIS 14596
Copper corrosion	rating		C1	ISO 2160
Electrical Conductivity	pS/m	200		ASTM D 2624

Distillation characteristics :				
At E70°C	%v/v	20.0	48.0	ISO 3405
At E100°C	%v/v	46.0	71.0	ISO 3405
At E150°C	%v/v	75.0		ISO 3405
Final Boiling Point	°C		210	ISO 3405
Residue	%v/v		2.0	ISO 3405

The fuel will be accepted or rejected according to ASTM D 3244 with a confidence limit of 95%

19.4 Composition of the fuel :

19.4.1 The composition of the petrol must comply with the detailed below:

	Units	Min	Max	Test Method
Aromatics	%v/v	0*	35*	ASTM D 1319
Olefins	%v/v	0	18*	ASTM D 1319
Total di-olefins	%m/m	0	1	GCMS
Total styrene and alkyl derivatives	%m/m		1	GCMS

*Values when corrected for fuel oxygenate content.
In addition, the fuel must contain no substance which is capable of exothermic reaction in the absence of external oxygen.

19.4.2 The total of individual hydrocarbon components present at concentrations of less than 5%m/m must be at least 30% m/m of the fuel.

19.4.3 The total concentration of each hydrocarbon group in the total fuel sample (defined by carbon number and hydrocarbon type), must not exceed the limits given in the table below:

% m/m	C4	C5	C6	C7	C8	C9+	Non PONA*	Unas signed
Paraffins	10	30	25	25	55	20	-	
Naphtenes	-	5	10	10	10	10	-	
Olefins	5	20	20	15	10	10	-	
Aromatics	-	-	1,2	35	35	30	-	
Maximum	15	40	45	50	60	45	1	5

* Non PONA are components not meeting definitions in 19.2 and 19.4.4

For the purposes of this table, a gas chromatographic technique must be employed which can classify hydrocarbons in the total fuel sample such that all those identified are allocated to the appropriate cell of the table. Compounds present at concentrations below 0.1% by mass may be deemed unassigned, except that it is the responsibility of the fuel approval laboratory to ensure that components representing at least 95% by mass of the total fuel are assigned.

The sum of the non PONA and unassigned hydrocarbons must not exceed 5.0% by mass of the total fuel sample.

19.4.4 The only oxygenates permitted are :
- Methanol (MeOH)
- Ethanol (EtOH)
- Iso-propyl alcohol (IPA)
- Iso-butyl alcohol (IBA)
- Methyl Tertiary Butyl Ether (MTBE)
- Ethyl Tertiary Butyl Ether (ETBE)
- Tertiary Amyl Methyl Ether (TAME)
- Di-Isopropyl Ether (DIPE)
- n-Propyl alcohol (NPA)
- Tertiary Butyl Alcohol (TBA)
- n-Butyl Alcohol (NBA)
- Secondary Butyl Alcohol (SBA)

Compounds normally found as impurities in any of the above oxygenates are permitted at concentrations below 0.8% m/m of the total petrol sample.

19.4.5 Manganese based additives are not permitted

19.5 Air :

Only ambient air may be mixed with the fuel as an oxidant.

19.6 Safety :

19.6.1 Manganese based additives are not permitted.

19.6.2 All competitors must be in possession of a Material Safety Data Sheet for each type of petrol used. This sheet must be made out in accordance with EC Directive 93/112/EEC and all information contained therein strictly adhered to.

19.7 Fuel approval :

19.7.1 Before any fuel may be used in an Event, two separate five litre samples, in suitable containers, must be submitted to the FIA for analysis and approval.

19.7.2 No fuel may be used in an Event without prior written approval of the FIA.

19.8 Sampling and testing at an Event:

19.8.1 All samples will be taken in accordance with FIA Formula One fuel sampling procedure, a copy of which may be found in the Appendix to these regulations.

19.8.2 Fuel samples taken during an Event will be checked for conformity by using densitometry and a gas chromatographic technique which will compare the sample taken with an approved fuel. Samples, which differ from the approved fuel in a manner consistent with evaporative loss, will be considered to conform. However, the FIA retains the right to subject the fuel sample to further testing at an FIA approved laboratory.

19.8.3 GC peak areas of the sample will be compared with those obtained from the reference fuel. Increases in any given peak area (relative to its adjacent peak areas) which are greater than 12%, or an absolute amount greater than 0.1% for compounds present at concentrations below 0.8%, will be deemed not to comply.

If a peak is detected in a fuel sample that was absent in the corresponding reference fuel, and its peak area represents more than 0.10% of the summed peak areas of the fuel, the fuel will be deemed not to comply.

19.9 Amendments to Article 19 :

19.9.1 The physical and compositional properties of the fuel described in 19.3 and 19.4 incorporate the currently known limits for 2000, as laid out in European Fuels Directive 98/70/EC (13 October 1998).

19.9.2 When the Final Directive, as defined by the FIA, is adopted for 2005 (or such other date as the Directive may specify), the new values will replace those being used in 19.3 and 19.4 no later than one year after the figures are known.

ARTICLE 20 : TELEVISION CAMERAS

20.1 Presence of cameras and camera housings :

All cars must be fitted with either two cameras, two camera housings or one of each at all times throughout the Event.

20.2 Location of camera housings :

Camera housings, when used, must be fitted in the same location as cameras. Details concerning the size and weight of all camera housings may be found in the Appendix to these regulations.

20.3 Location and fitting of camera equipment :

20.3.1 All cars must be equipped with five positions in which cameras or camera housings can be fitted. Referring to Drawing 6, all cars must carry a camera or camera housing in position 4, the position of the remaining camera or camera housing will be determined by the FIA after consultation with the relevant Competitor.
Once positions are determined in the above manner, any decision as to whether a camera or camera housing is fitted in those positions will rest solely with the relevant Competitor.

20.3.2 Any camera or dummy camera fitted in positions 1, 2 or 3 shown in Drawing 6 must be mounted in order that its major axis does not subtend an angle greater than 5° to the reference plane.

20.4 Transponders :

All cars must be fitted with a timing transponder supplied by the officially appointed timekeepers. This transponder must be fitted in strict accordance with the instructions detailed in the Appendix to these regulations.

ARTICLE 21 : FINAL TEXT

The final text for these regulations shall be the English version should any dispute arise over their interpretation.

ARTICLE 22 : CHANGES FOR 2005

22.1 Amendments to Article 6.2.1 :

6.2.1 All apertures in the fuel tank must be closed by hatches or fittings which are secured to metallic or composite bolt rings bonded to the inside of the bladder. The total area of any such hatches or fittings which are in contact with the fuel may not exceed 30000mm².
Bolt hole edges must be no less than 5mm from the edge of the bolt ring, hatch or fitting.

22.2 Amendments to Article 17.1 :

17.1 Conditions applicable to both roll structure tests :

17.1.1 Rubber 3mm thick may be used between the load pads and the roll structure.

17.1.2 Both peak loads must be applied in less than three minutes and be maintained for 10 seconds.

17.1.3 Under the load, deformation must be less than 50mm, measured along the loading axis and any structural failure limited to 100mm below the top of the rollover structure when measured vertically.

17.1.4 Any significant modification introduced into any of the structures tested shall require that part to pass a further test.

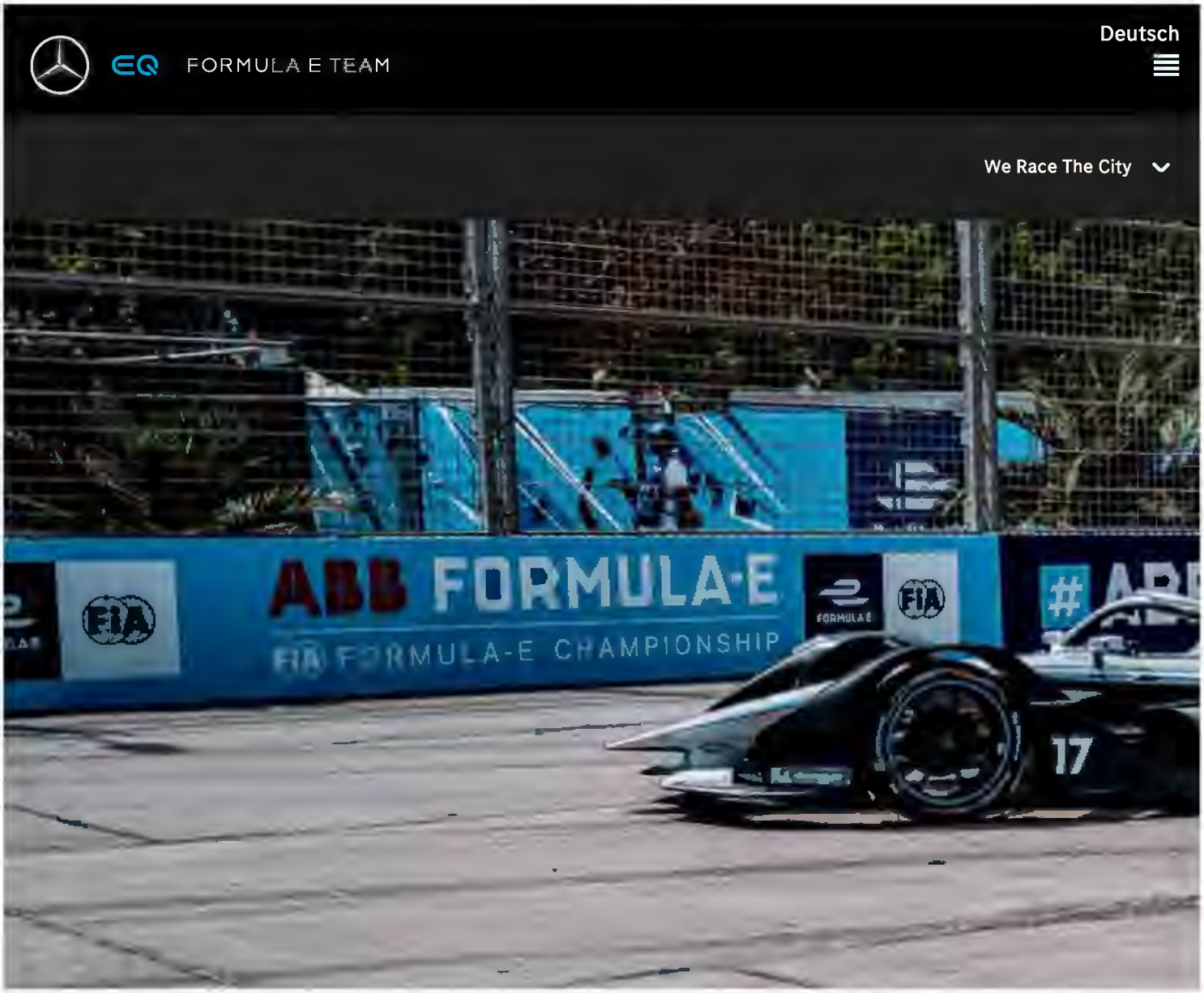
22.3 Amendments to Article 18.6 :

18.6 Side intrusion test

18.6.1 The test must be carried out in accordance with FIA Test Procedure 02/05, in the presence of an FIA technical delegate and by using measuring equipment which has been calibrated to the satisfaction of the FIA technical delegate.

18.6.2 The test panel must be 500mm x 500mm and will be tested by forcing a rigid truncated cone through the centre of the panel at a rate of 2mm (+/-1mm) per second until the displacement exceeds 150mm.
During the first 100mm of displacement the load must exceed 250kN and there must be no damage to the fixture before this requirement has been met.

EXHIBIT D



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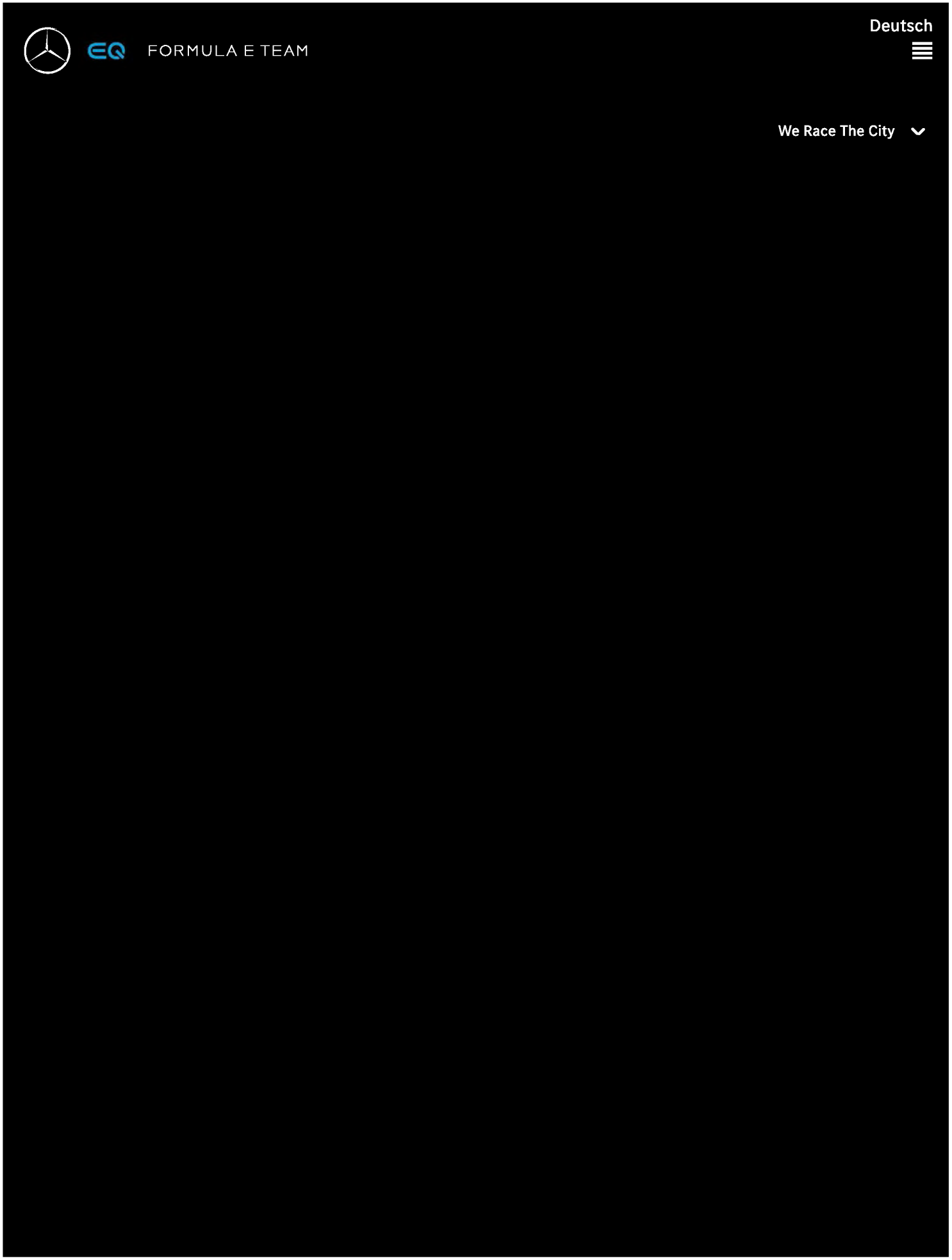
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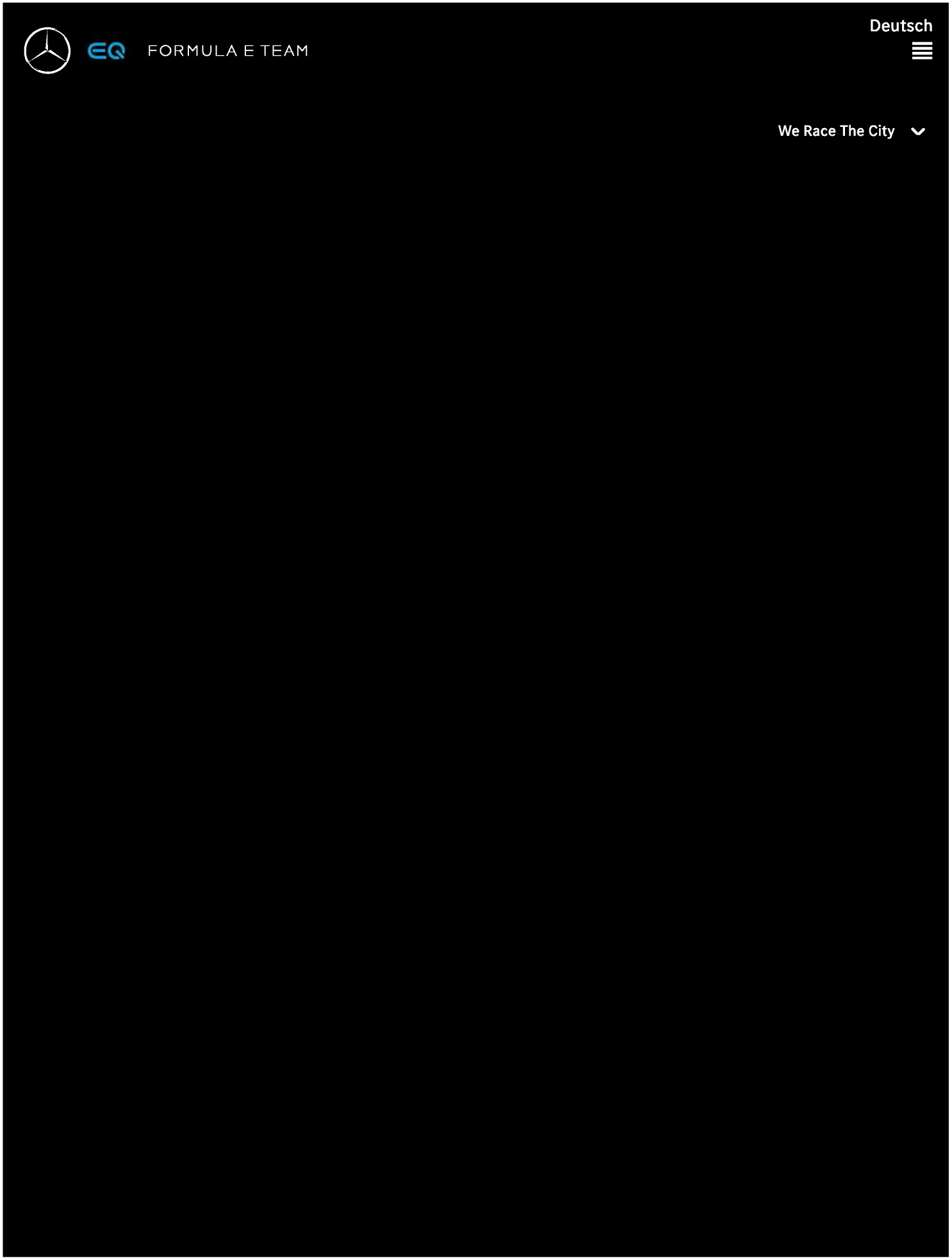
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EXHIBIT E

DEFENDANTS' INVALIDITY CONTENTIONS

EX. A-01 – Invalidity of U.S. Patent 7,494,178 Over U.S. Patent No. 1,965,625 ("Anderson")

Application No. 672,242 was filed by Roy F. Anderson on May 22, 1933, published on July 10, 1934 as U.S. Patent No. 1,965,625 ("Anderson"), as demonstrated by at least the document itself, the records of the United States Patent Office, and/or the testimony of knowledgeable witnesses and corroborating documents. Anderson is prior art to U.S. Patent No. 7,494,178 ("the '178 Patent") under at least 35 U.S.C. § 102(a) and (b).

Anderson anticipates one or more of the asserted claims under at least 35 U.S.C. § 102. Anderson further renders one or more of the asserted claims invalid as obvious under 35 U.S.C. § 103, either alone or in combination with one or more other references cited in Defendants' Invalidity Contentions. These references are analogous art because each is directed to the same or similar field of endeavor and each teaches methods and/or systems to address the same or similar problem in the field, namely vehicles and strengthening members for said vehicles.

The following claim chart demonstrates how Anderson discloses each element of the asserted claims. To the extent any limitation is not explicitly disclosed, each limitation is at least implicitly or inherently disclosed, or would have been obvious in view of Anderson in combination with the general knowledge of a person of ordinary skill in the art and/or one or more of the prior art references identified in Defendants' Invalidity Contentions as identified herein and/or in Section II.D. of Defendants' Preliminary Invalidity Contentions cover pleading.

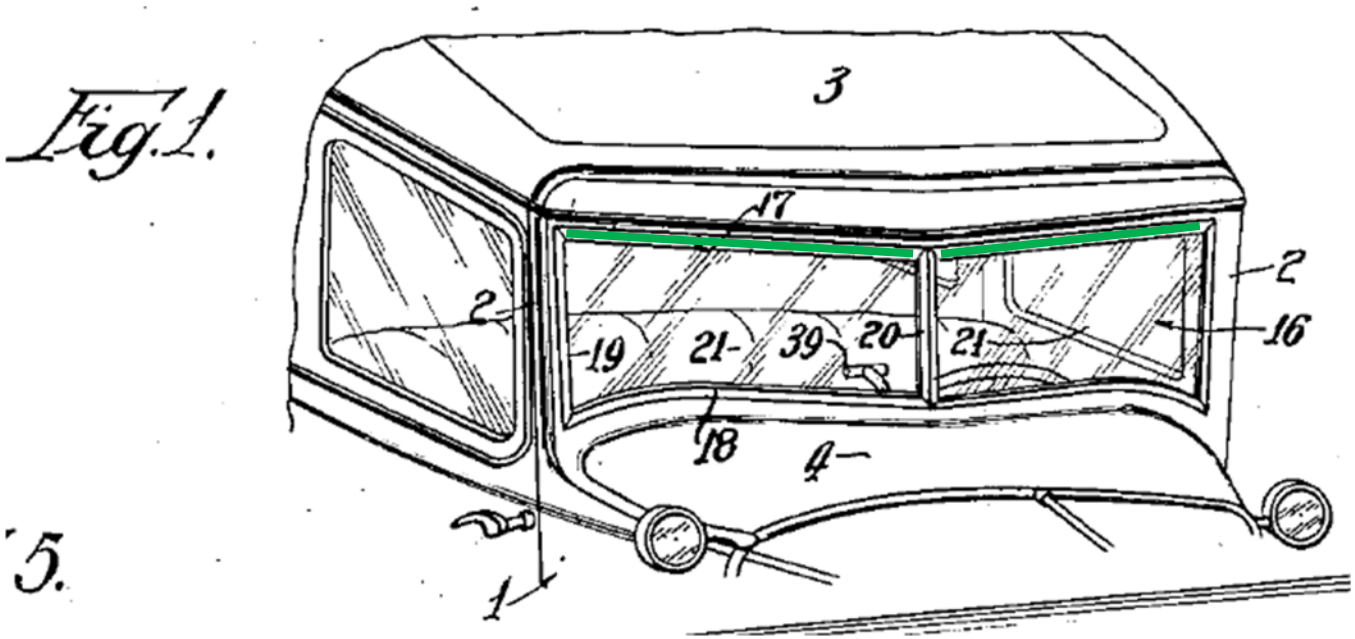
With respect to the obviousness of the asserted claim under 35 U.S.C. § 103, one of ordinary skill would have been motivated to combine references or teachings at least based on one or more of the principles enumerated by the United States Supreme Court in *KSR v. Teleflex*, 550 U.S. 398 (2007), including: (a) combining various claimed elements known in the prior art according to known methods to yield a predictable result; and/or (b) making a simple substitution of one or more known elements for another to obtain a predictable result; and/or (c) using a known technique to improve a similar device or method in the same way; and/or (d) applying a known technique to a known device or method ready for improvement to yield a predictable result; and/or (e) choosing from a finite number of identified, predictable solutions with a reasonable expectation of success or, in other words, the solution was one which was "obvious to try"; and/or (f) a known work in one field of endeavor prompting variations of it for use either in the same field or a different field based on given design incentives or other market forces in which the variations were predictable to one of ordinary skill in the art; and/or (g) a teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill in the art to modify

the prior art reference or to combine the teachings of various prior art references to arrive at the claimed invention. One of ordinary skill may apply other motivations to combine, as obviousness is a flexible analysis. It therefore would have been obvious to one of ordinary skill in the art to combine the disclosures of these references in accordance with the principles and rationales set forth above or additional rationales that one of ordinary skill would have used.

In compiling these contentions, Defendants have relied in part on Nygaard's infringement contentions served pursuant to the Court's Order Governing Proceedings – Patent Case. In those contentions, Nygaard appears to assign constructions to indefinite claim language, to pursue overly broad claim constructions in an effort to assert infringement where none exists, and to accuse products that do not infringe the claims. Nygaard also contends that no elements of the asserted claims are governed by 35 U.S.C. § 112(6) and fails to cite any document or identify accused structures, acts, or materials in the accused products with particularity. Defendants' assertion that a particular limitation is disclosed by a prior art reference and/or is disclosed in a particular manner may be based in part on Nygaard's apparent claim interpretations. In relying on Nygaard's apparent claim interpretations, Defendants do not admit that Nygaard's apparent claim interpretations are supportable or proper, that the elements of the claims are not governed by 35 U.S.C. § 112(6), or that the claim limitations in question are definite or otherwise amenable to construction.

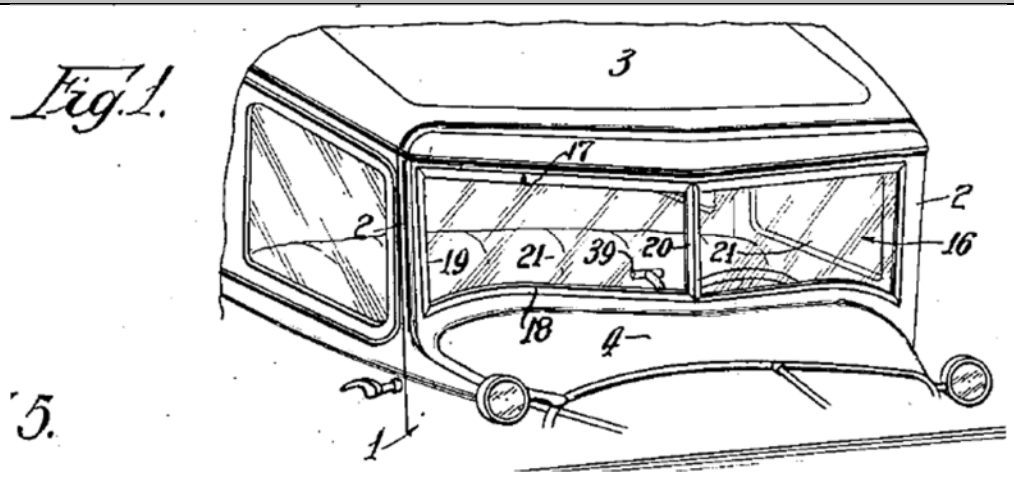
Defendants have endeavored to provide as much detail as possible in these contentions and, in doing so, have exceeded the level of detail required. The inclusion of specific details in some areas is not a concession that such details are required or that the omission of similar details in other areas is a defect. The citations to portions of any reference in this chart are exemplary only. Defendants will rely on the entirety of the references cited in this chart to show that the asserted claims are invalid.

Claim	Anderson
Claim 1:	
[Preamble] A strengthening member	To the extent this preamble is deemed limiting, Anderson discloses a strengthening member. For example, Anderson discloses and/or renders obvious a strengthening member that comprises a front beam (colored orange), and the top of the window frame structures (shown in green). Anderson recites

Claim	Anderson
	details about the center post, namely that the "center post 20 which is comparatively narrow, considered transversely, is hollow and is offset at the bottom as at 23."  To the extent this claim limitation is not expressly disclosed, Anderson renders obvious to one skilled in the art a strengthening member.
[a][i] for use in a road vehicle,	Anderson discloses a strengthening member for use in a road vehicle. Anderson discloses and/or renders obvious that the strengthening member is for use in a road vehicle. For example, Anderson shows the strengthening members affixed to a vehicle.

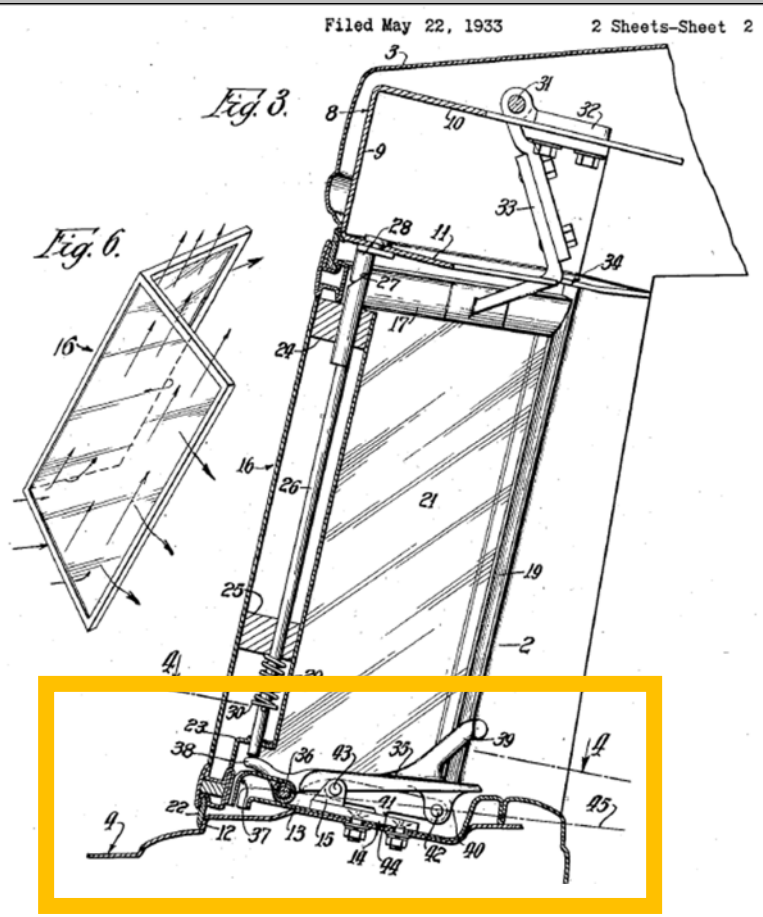
DEFENDANTS' INVALIDITY CONTENTIONS

EX. A-01 – Invalidity of U.S. Patent 7,494,178 Over U.S. Patent No. 1,965,625 ("Anderson")

Claim	Anderson
	
[a][ii] for fixing to a structure of the vehicle, and	Anderson discloses a strengthening member for fixing to a structure of the vehicle. For example, Anderson discloses and/or renders obvious a strengthening member for fixing to a structure of the vehicle. For example, Anderson describes how the center post is affixed to the frame of the vehicle. "The center post 20 which is comparatively narrow, considered transversely, is hollow and is offset at the bottom as at 23. . . . The front end of said leve is pivoted at 36 to a bracket 37 extending rearwardly from the bottom end of the center post at a point below its offset 23. This front end of said lever includes an extension 38 adapted for engagement with the bottom extremity of the locking rod 26 in the center post. The other end of said lever 35 includesan upwardly and rearwardly extending handle 39 and a depending ear 40. A link 41 is pivoted at one end as at 42 to said ear 40 and is pivoted at its other end as at 43 to the ear 15 of the bracket 14. This link is provided along one edge at a point between its ends with a shoulder lug 44, that normally engages on the bracket 14 when the windshield is in its closed and locked position." (2:54-56, 89-111). Further, Figure 3 shows, from a side-view, the strengthening member affixed to a structure of the vehicle (shown in the orange box below).

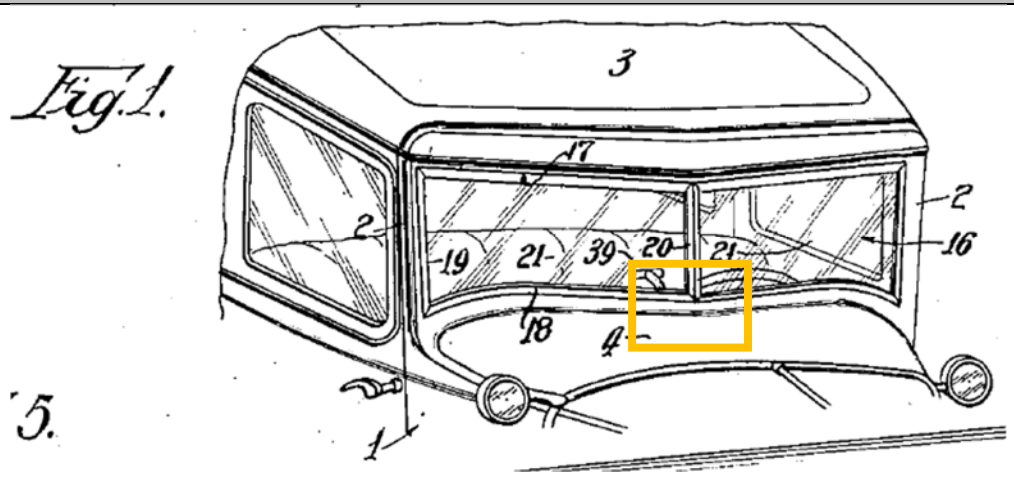
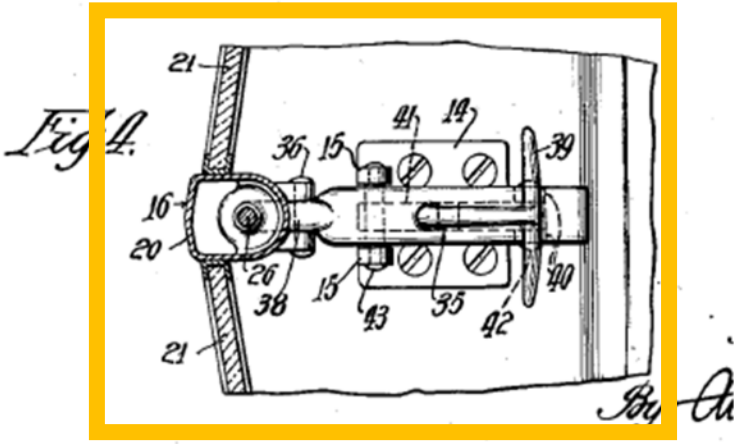
DEFENDANTS' INVALIDITY CONTENTIONS

EX. A-01 – Invalidity of U.S. Patent 7,494,178 Over U.S. Patent No. 1,965,625 ("Anderson")

Claim	Anderson
	 Similarly, Figure 1 shows from a front-view the strengthening member affixed to a structure of the vehicle (shown in the orange box below).

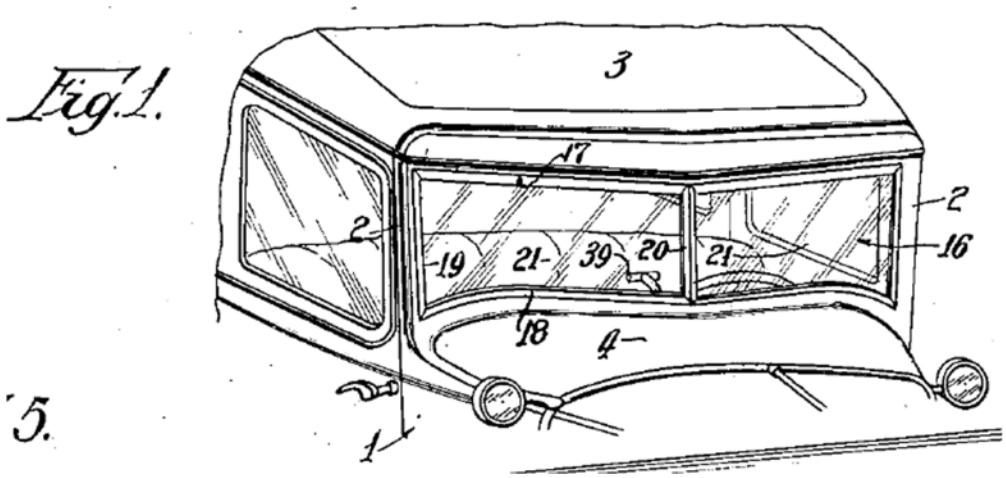
DEFENDANTS' INVALIDITY CONTENTIONS

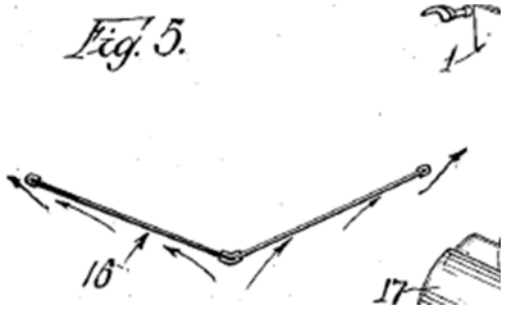
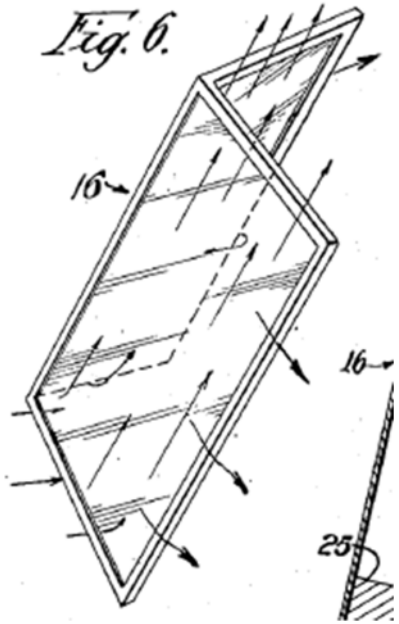
EX. A-01 – Invalidity of U.S. Patent 7,494,178 Over U.S. Patent No. 1,965,625 ("Anderson")

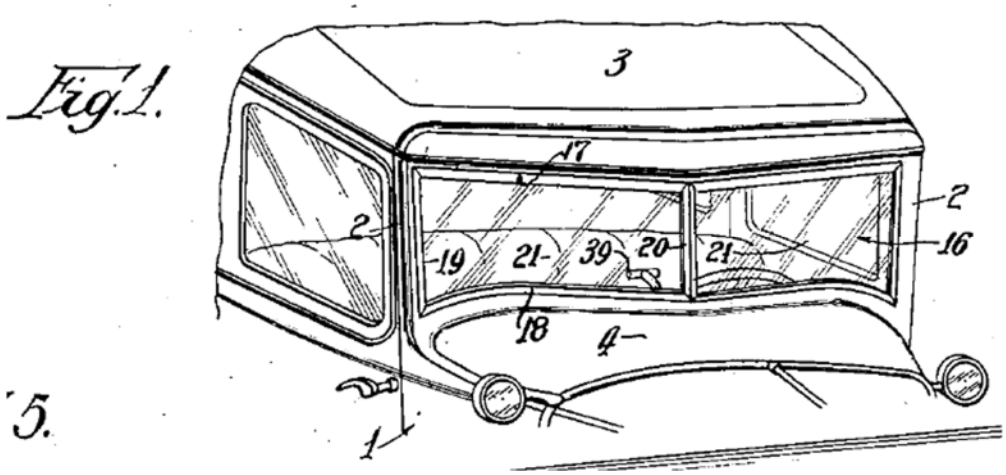
Claim	Anderson
	 Figure 4 also shows, but from a bird's-eye view, the strengthening member affixed to a structure of the vehicle (shown in the orange box below). 

DEFENDANTS' INVALIDITY CONTENTIONS

EX. A-01 – Invalidity of U.S. Patent 7,494,178 Over U.S. Patent No. 1,965,625 ("Anderson")

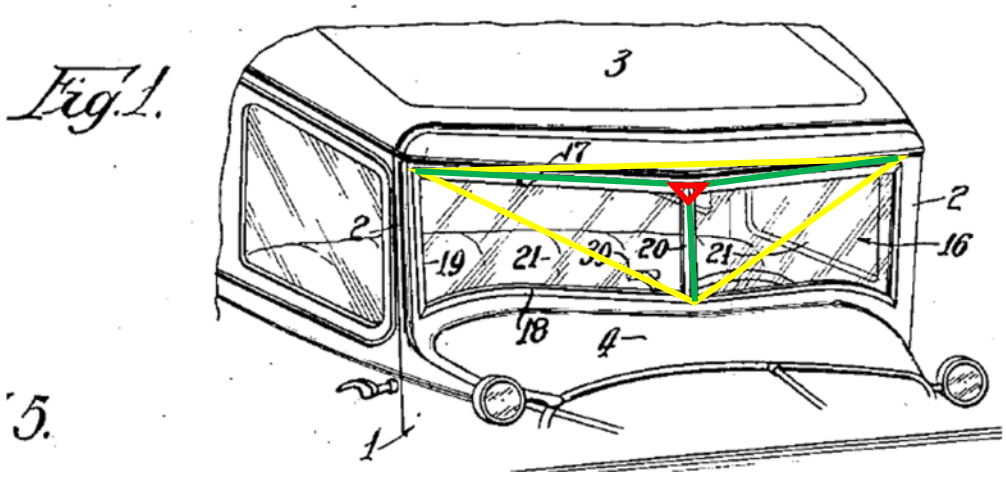
Claim	Anderson
[a][iii] for extending in front of the driver's position,	Anderson discloses a strengthening member for extending in front of the driver's position. For example, Anderson discloses and/or renders obvious a strengthening member is for extending in front of the driver's position. Figure 1 shows the strengthening member extending in front of the driver's seat. 
[b][i] the strengthening member being dimensioned so that, when in use, the strengthening member will not prevent the driver from seeing an object which is at least 2 m from the front windscreen, when the driver uses binocular	Anderson discloses the strengthening member being dimensioned so that, when in use, the strengthening member will not prevent the driver from seeing an object which is at least 2 m from the front windscreen, when the driver uses binocular vision, and without requiring the driver to move the driver's head. For example, Anderson discloses and/or renders obvious a strengthening member that is dimensioned so that, when in use, the strengthening member will not prevent the driver from seeing an object which is at least 2 m from the front windscreen, when the driver uses binocular vision, and without requiring the driver to move the driver's head. The Anderson specification recites that the "center post 20 which is comparatively narrow, considered transversely, is hollow . . . ."

Claim	Anderson
vision, and without requiring the driver to move the driver's head,	Figures 5 and 6 illustrate just how narrow the center post is designed to be (center post colored orange), and further illustrate the windscreen (colored blue).  

Claim	Anderson
	Further, Figure 1 illustrates the center post (colored orange) in relation to the steering wheel (colored dark green), which is thin, and a windscreen (colored blue).  Alternatively, one skilled in the art would understand, based on the pictures and disclosure in Anderson alone, or in combination with one or more of the references charted in Exhibits A-1 to A-30, and the knowledge of one of ordinary skill in the art, that the strengthening member is dimensioned so that it would not prevent the driver from seeing objects in front of the vehicle. For example, it would have been obvious to one skilled in the art to modify the strengthening member structures disclosed in Anderson so it will not prevent the driver from seeing an object which is at least 2 m from the front windscreen, when the driver uses binocular vision, and without requiring the driver to move the driver's head, in view of the teachings of Anderson or, for example, as discussed in Defendants' Invalidity Contentions Cover Pleading at Section II.D.

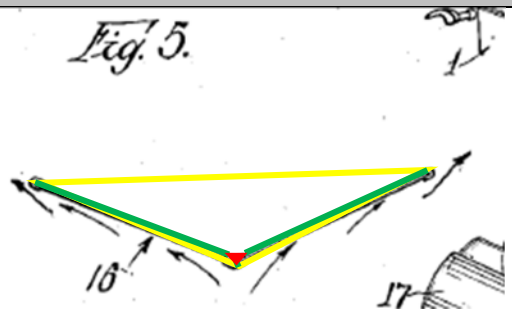
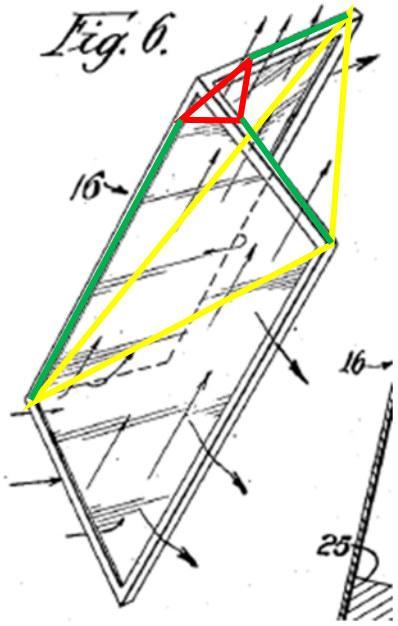
DEFENDANTS' INVALIDITY CONTENTIONS

EX. A-01 – Invalidity of U.S. Patent 7,494,178 Over U.S. Patent No. 1,965,625 ("Anderson")

Claim	Anderson
[c] wherein the strengthening member has the form of a triangular prism which has been sheared in a vertical plane or the form of a truncated sheared triangular pyramid.	Anderson discloses a strengthening member wherein the strengthening member has the form of a triangular prism which has been sheared in a vertical plane or the form of a truncated sheared triangular pyramid. For example, Anderson discloses and/or renders obvious a strengthening member wherein the strengthening member has the form of a triangular prism which has been sheared in a vertical plane or the form of a truncated sheared triangular pyramid. Figure 1 shows a strengthening member that meets this limitation.  Further, the strengthening member meets this limitation as shown in Figures 5 and 6.

DEFENDANTS' INVALIDITY CONTENTIONS

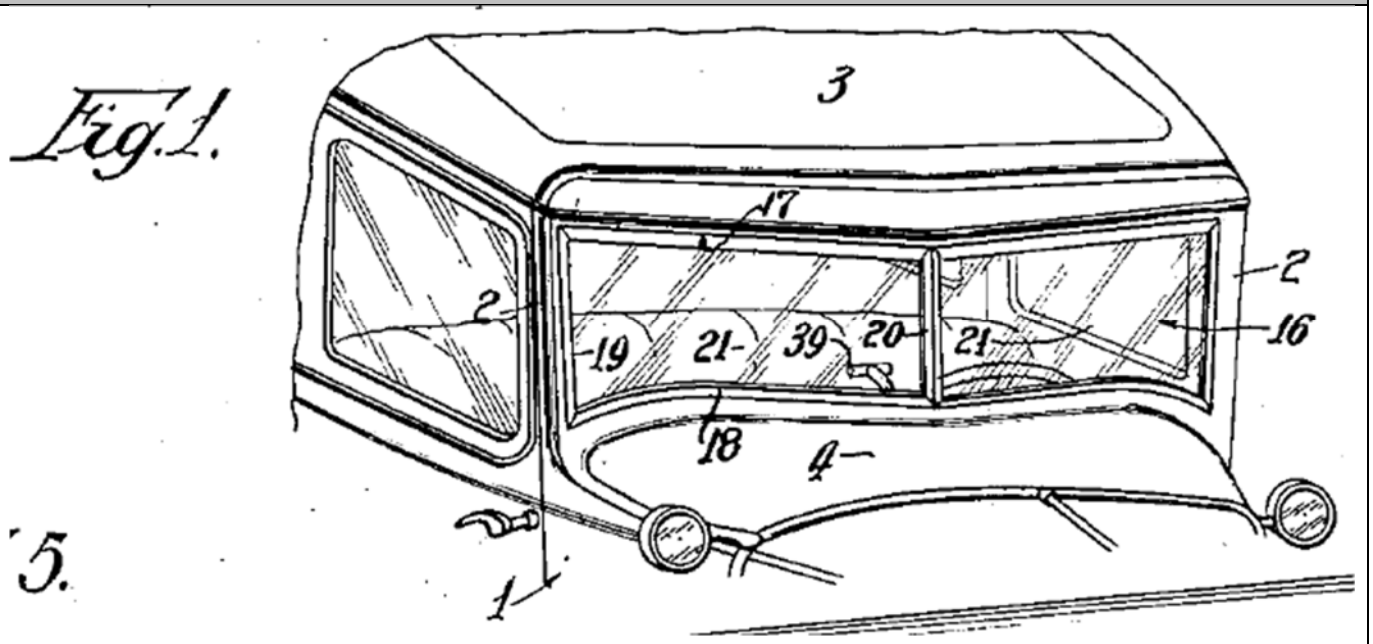
EX. A-01 – Invalidity of U.S. Patent 7,494,178 Over U.S. Patent No. 1,965,625 ("Anderson")

Claim	Anderson
	  Alternatively, one skilled in the art would understand, based on the pictures and disclosure in Anderson alone, or in combination with one or more of the references charted in Exhibits A-1 to A-30, and the

Claim	Anderson
	knowledge of one of ordinary skill in the art, how to configure the strengthening member so that it has the form of a triangular prism which has been sheared in a vertical plane or the form of a truncated sheared triangular pyramid. For example, it would have been obvious to one skilled in the art to modify the strengthening member in Anderson to form a triangular prism sheared in a vertical plane or a truncated sheared triangular pyramid, in view of the teachings of Anderson or, for example, as discussed in Defendants' Invalidity Contentions Cover Pleading at Section II.D.
Claim 2:	
[Preamble] A strengthening member for mounting in a vehicle,	To the extent this preamble is deemed limiting, Anderson discloses a strengthening member for mounting in a vehicle. For example, Anderson discloses and/or renders obvious a strengthening member for mounting in a vehicle that comprises a front beam (colored orange), a top structure, and rear beams that frame the rear of the vehicle cabin and extend down to the body. Alternatively, to the extent a strengthening member is interpreted as a single pillar, Anderson discloses such a strengthening member (colored orange) for mounting in a vehicle. Further, Anderson recites details about the center post, namely that the "center post 20 which is comparatively narrow, considered transversely, is hollow and is offset at the bottom as at 23."

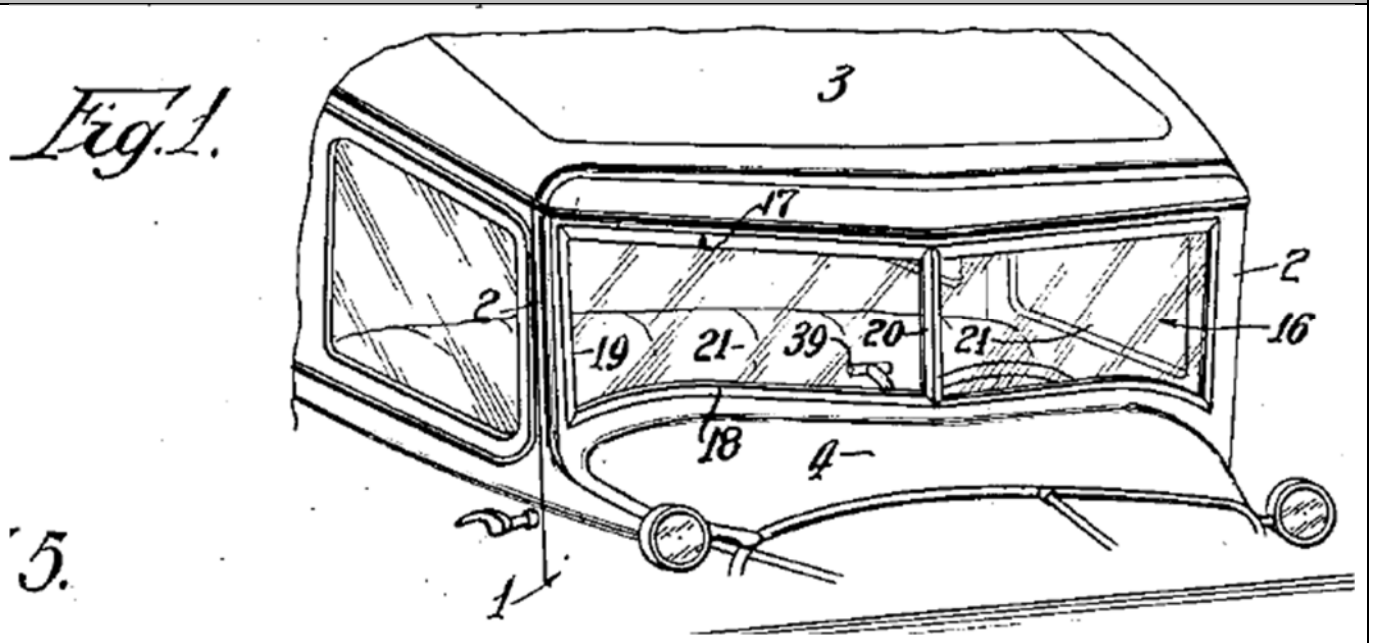
DEFENDANTS' INVALIDITY CONTENTIONS

EX. A-01 – Invalidity of U.S. Patent 7,494,178 Over U.S. Patent No. 1,965,625 ("Anderson")

Claim	Anderson
	 To the extent this claim limitation is not expressly disclosed, Anderson renders obvious to one skilled in the art a strengthening member.
[a] formed of at least three first linearly extending structural units placed in a triangular arrangement,	Anderson discloses a strengthening member formed of at least three first linearly extending structural units placed in a triangular arrangement. For example, Anderson discloses and/or renders obvious a strengthening member formed of at least three first linearly extending structural units placed in a triangular arrangement.

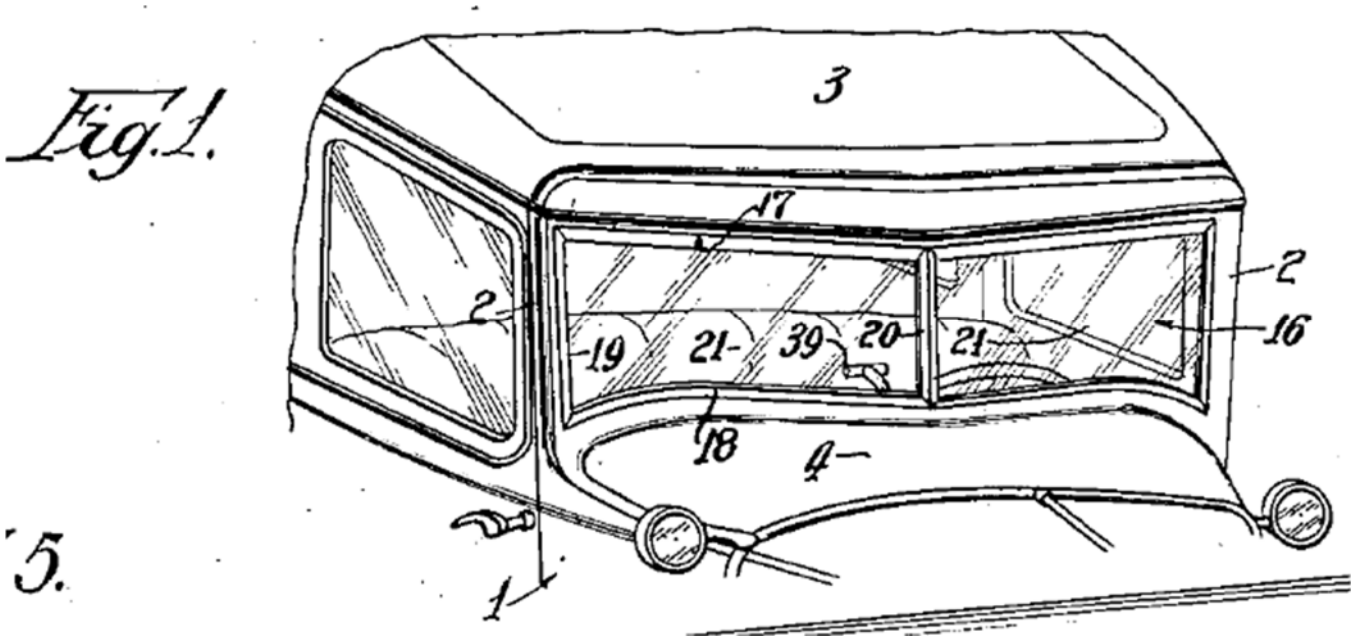
DEFENDANTS' INVALIDITY CONTENTIONS

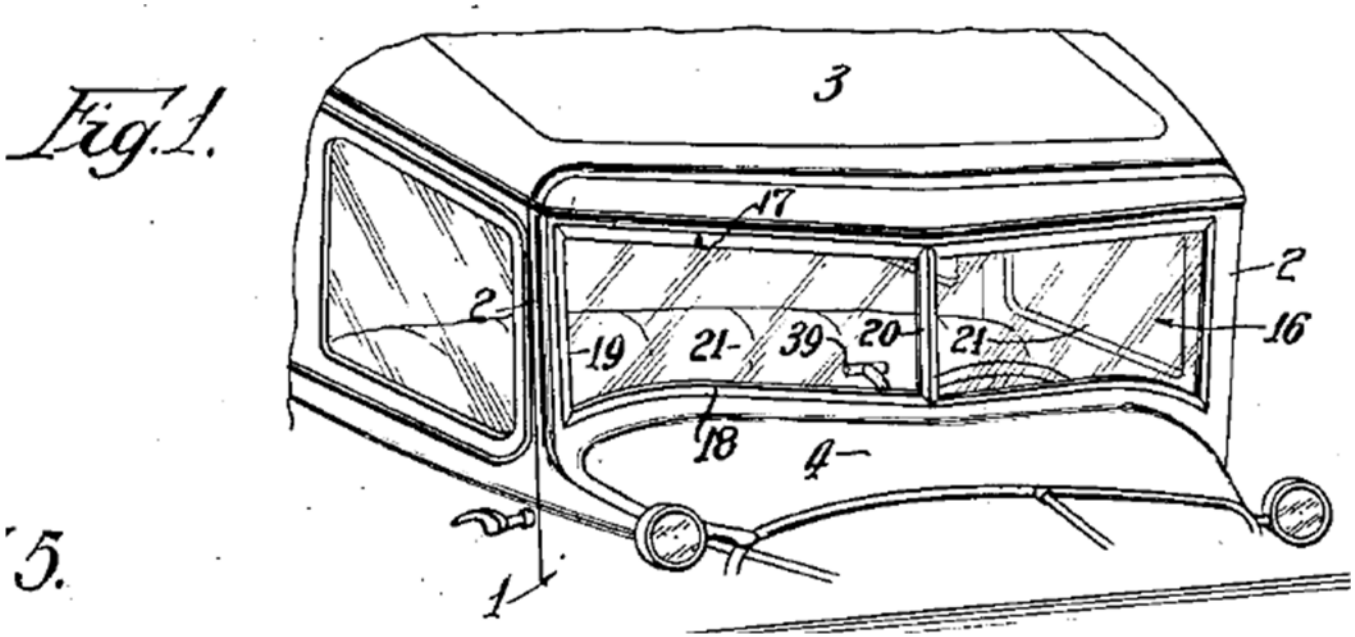
EX. A-01 – Invalidity of U.S. Patent 7,494,178 Over U.S. Patent No. 1,965,625 ("Anderson")

Claim	Anderson
	 Alternatively, one skilled in the art would understand, based on the pictures and disclosure in Anderson alone, or in combination with one or more of the references charted in Exhibits A-1 to A-30, and the knowledge of one of ordinary skill in the art, how to configure the strengthening member so that it is formed of at least three structural units in a triangular arrangement. For example, it would have been obvious to one skilled in the art to modify the strengthening member structures in Anderson to form a triangular arrangement of three linearly extending structural units, in view of the teachings of Anderson or, for example, as discussed in Defendants' Invalidity Contentions Cover Pleading at Section II.D.

DEFENDANTS' INVALIDITY CONTENTIONS

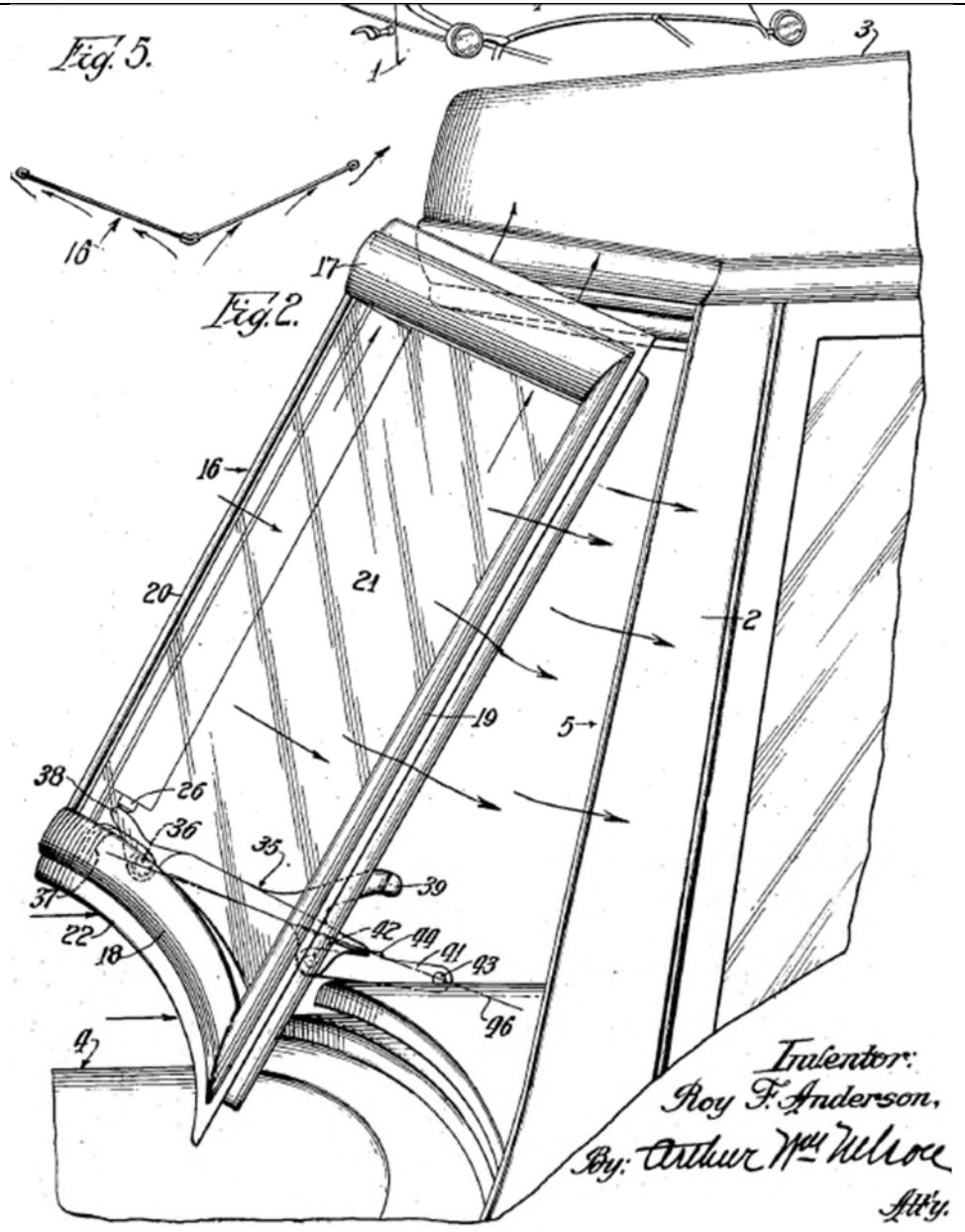
EX. A-01 – Invalidity of U.S. Patent 7,494,178 Over U.S. Patent No. 1,965,625 ("Anderson")

Claim	Anderson
[b] for extending from the front structure of the vehicle, and	Anderson discloses a strengthening member for extending from the front structure of the vehicle. For example, Anderson discloses and/or renders obvious a strengthening member for extending from the front structure of the vehicle as shown in Figure 1. 
[c] second linearly extending structural unit joining the at least three	Anderson discloses a second linearly extending structural unit joining the at least three first linearly extending units.

Claim	Anderson
first linearly extending units,	For example, Anderson discloses and/or renders obvious a second linearly extending structural unit joining the at least three first linearly extending units.  Figure 2 additionally shows a second linearly extending structural unit joining the at least three first linearly extending units.

DEFENDANTS' INVALIDITY CONTENTIONS

EX. A-01 – Invalidity of U.S. Patent 7,494,178 Over U.S. Patent No. 1,965,625 ("Anderson")



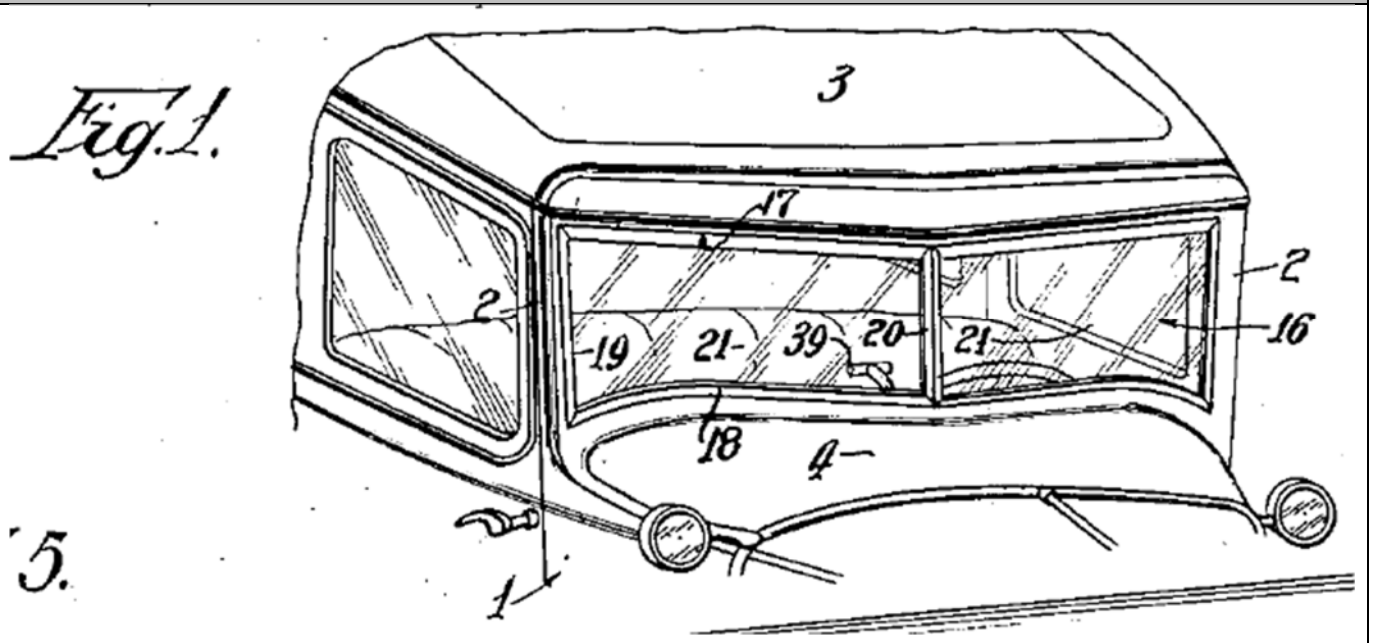
DEFENDANTS' INVALIDITY CONTENTIONS

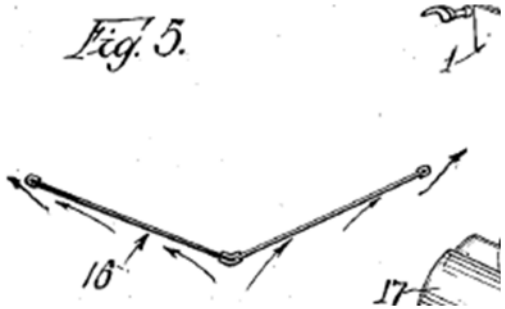
EX. A-01 – Invalidity of U.S. Patent 7,494,178 Over U.S. Patent No. 1,965,625 ("Anderson")

Claim	Anderson
	Alternatively, one skilled in the art would understand, based on the pictures and disclosure in Anderson alone, or in combination with one or more of the references charted in Exhibits A-1 to A-30, and the knowledge of one of ordinary skill in the art, how to configure the strengthening member so that it is formed of at least three structural units in a triangular arrangement joined by second linearly extending structural units. For example, it would have been obvious to one skilled in the art to configure the strengthening member in Anderson to form a triangular arrangement of three linearly extending structural units joined by second linearly extending structural units, in view of the teachings of Anderson or, for example, as discussed in Defendants' Invalidity Contentions Cover Pleading at Section II.D.
[d] the second structural units being not horizontal,	Anderson discloses the second structural units being not horizontal. For example, Anderson discloses and/or renders obvious the second structural units is not horizontal.

DEFENDANTS' INVALIDITY CONTENTIONS

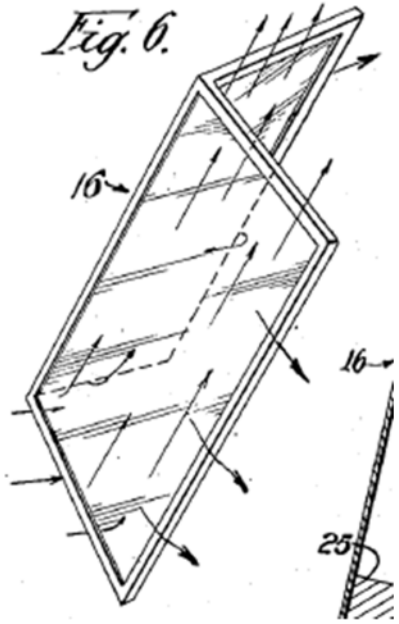
EX. A-01 – Invalidity of U.S. Patent 7,494,178 Over U.S. Patent No. 1,965,625 ("Anderson")

Claim	Anderson
	 To the extent this claim limitation is not expressly disclosed, Anderson renders obvious to one skilled in the art how to configure the second structural units to be not horizontal. Alternatively, one skilled in the art would understand, based on the pictures and disclosure in Anderson alone, or in combination with one or more of the references charted in Exhibits A-1 to A-30, and the knowledge of one of ordinary skill in the art, to use second linearly extending structural units that are not horizontal.

Claim	Anderson
	For example, it would have been obvious to one skilled in the art to modify the second linearly extending structural units in Anderson so they are not horizontal, in view of the teachings of Anderson or, for example, as discussed in Defendants' Invalidity Contentions Cover Pleading at Section II.D.
[e] wherein the first linearly extending structural units of the strengthening member have a width not exceeding 65 mm,	Anderson discloses a strengthening member wherein the first linearly extending structural units of the strengthening member have a width not exceeding 65 mm. For example, Anderson discloses and/or renders obvious the first linearly extending structural units of the strengthening member have a width not exceeding 65 mm first because the Anderson specification recites that the "center post 20 which is comparatively narrow, considered transversely, is hollow . . . ." Figures 5 and 6 illustrate just how narrow the center post is designed to be (center post colored orange). 

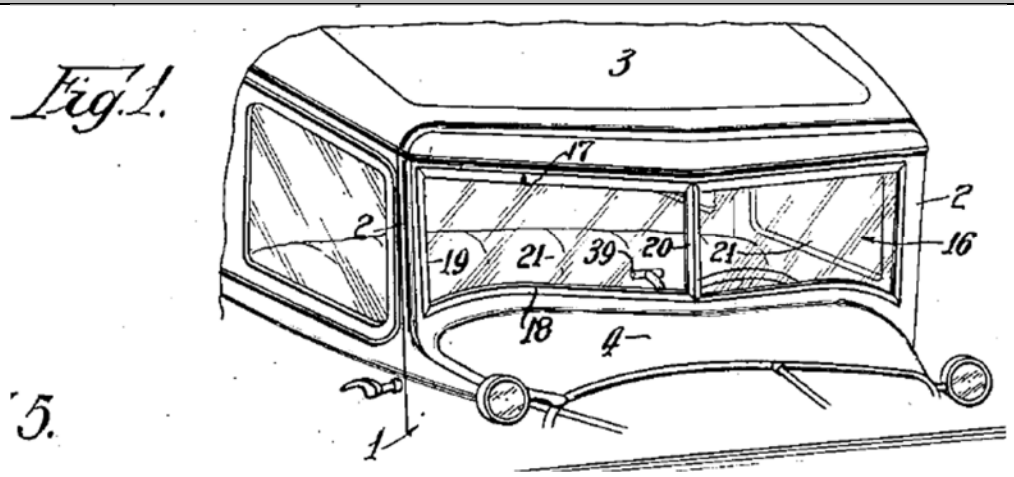
DEFENDANTS' INVALIDITY CONTENTIONS

EX. A-01 – Invalidity of U.S. Patent 7,494,178 Over U.S. Patent No. 1,965,625 ("Anderson")

Claim	Anderson
	 Further, Figure 1 illustrates the center post (colored orange) in relation to the steering wheel (colored dark green), which is thin.

DEFENDANTS' INVALIDITY CONTENTIONS

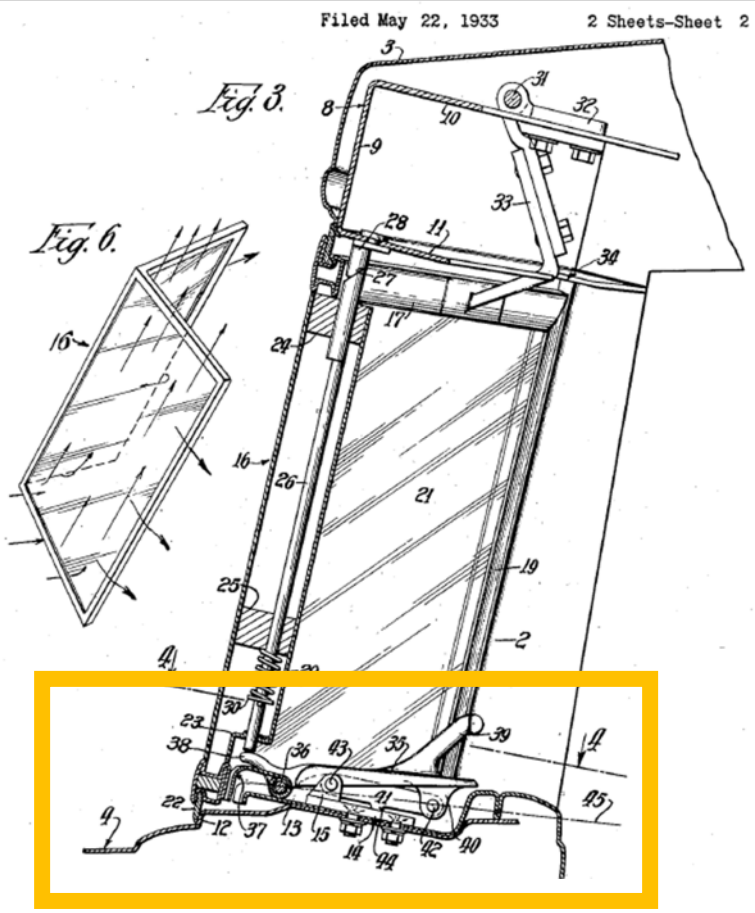
EX. A-01 – Invalidity of U.S. Patent 7,494,178 Over U.S. Patent No. 1,965,625 ("Anderson")

Claim	Anderson
	 Alternatively, one skilled in the art would understand, based on the pictures and disclosure in Anderson alone, or in combination with one or more of the references charted in Exhibits A-1 to A-30, and the knowledge of one of ordinary skill in the art, that the first linearly extending structural units of the strengthening member have a width not exceeding 65 mm. For example, it would have been obvious to one skilled in the art to modify the first linearly extending structural units in Anderson to have a width not exceeding 65mm, in view of the teachings of Anderson or, for example, as discussed in Defendants' Invalidity Contentions Cover Pleading at Section II.D.
[f] the strengthening member having a connection for fixing the strengthening member to the vehicle,	Anderson discloses the strengthening member having a connection for fixing the strengthening member to the vehicle. For example, Anderson discloses the strengthening member having a connection for fixing the strengthening member to the vehicle. For example, Anderson describes how the center post is affixed to the frame of the vehicle. "The center post 20 which is comparatively narrow, considered transversely, is hollow and is offset at the bottom as at 23. . . . The front end of said leve is pivoted at 36 to a bracket 37 extending rearwardly from the bottom end of the center post at a point below its offset 23. This front

Claim	Anderson
	end of said lever includes an extension 38 adapted for engagement with the bottom extremity of the locking rod 26 in the center post. The other end of said lever 35 includesan upwardly and rearwardly extending handle 39 and a depending ear 40. A link 41 is pivoted at one end as at 42 to said ear 40 and is pivoted at its other end as at 43 to the ear 15 of the bracket 14. This link is provided along one edge at a point between its ends with a shoulder lug 44, that normally engages on the bracket 14 when the windshield is in its closed and locked position." (2:54-56, 89-111). Further, Figure 3 shows, from a side-view, the strengthening member affixed to a structure of the vehicle (shown in the orange box below).

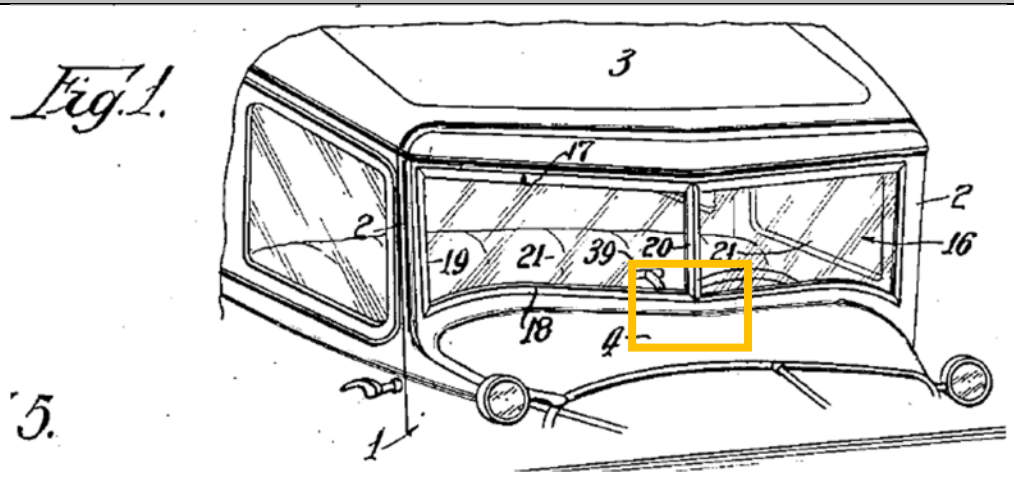
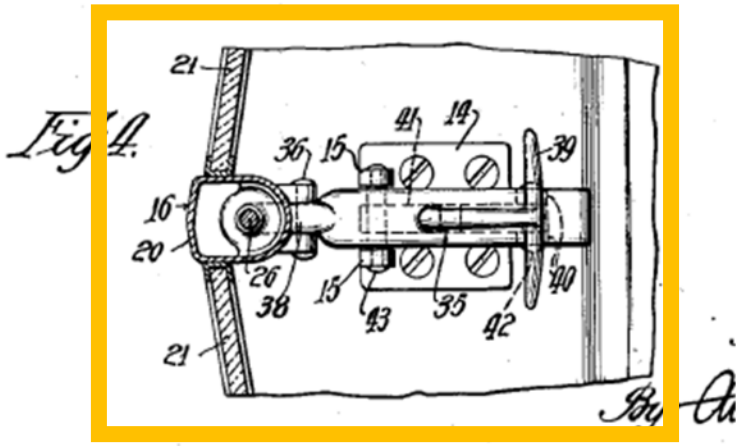
DEFENDANTS' INVALIDITY CONTENTIONS

EX. A-01 – Invalidity of U.S. Patent 7,494,178 Over U.S. Patent No. 1,965,625 ("Anderson")

Claim	Anderson
	 Similarly, Figure 1 shows from a front-view the strengthening member affixed to a structure of the vehicle (shown in the orange box below).

DEFENDANTS' INVALIDITY CONTENTIONS

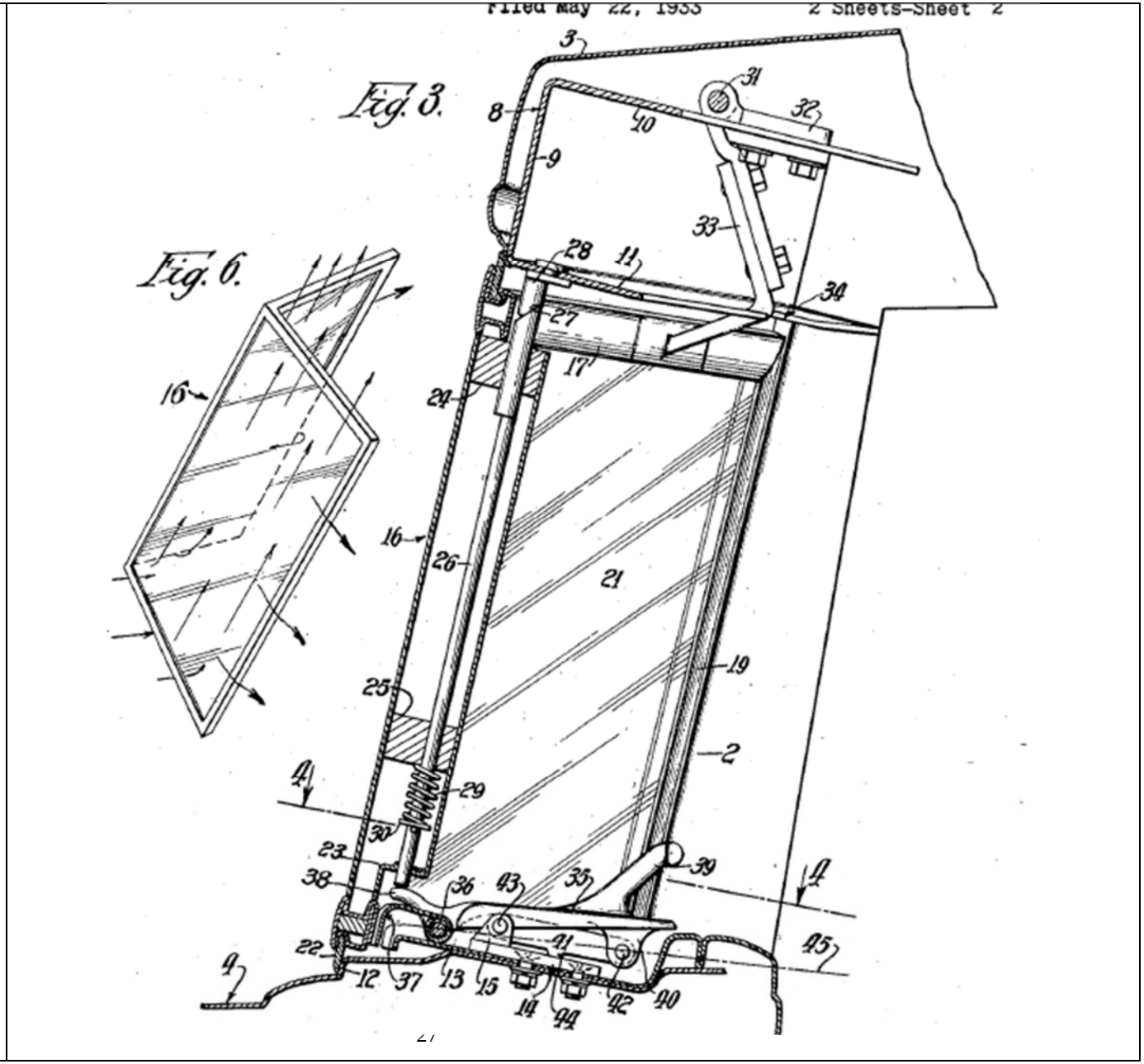
EX. A-01 – Invalidity of U.S. Patent 7,494,178 Over U.S. Patent No. 1,965,625 ("Anderson")

Claim	Anderson
	 Figure 4 also shows, but from a bird's-eye view, the strengthening member affixed to a structure of the vehicle (shown in the orange box below). 

Claim	Anderson
[g] whereby, when mounted in the vehicle, the strengthening member extends obliquely to the vertical direction of the vehicle.	Anderson discloses a strengthening member whereby, when mounted in the vehicle, the strengthening member extends obliquely to the vertical direction of the vehicle. For example, Anderson discloses a strengthening member whereby, when mounted in the vehicle, the strengthening member extends obliquely to the vertical direction of the vehicle. Figure 3 shows the strengthening member extending obliquely as required by this limitation.

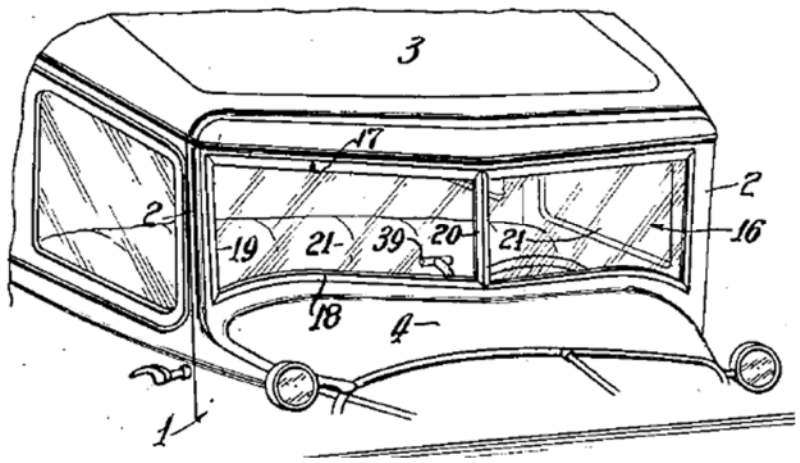
DEFENDANTS' INVALIDITY CONTENTIONS

EX. A-01 – Invalidity of U.S. Patent 7,494,178 Over U.S. Patent No. 1,965,625 ("Anderson")



DEFENDANTS' INVALIDITY CONTENTIONS

EX. A-01 – Invalidity of U.S. Patent 7,494,178 Over U.S. Patent No. 1,965,625 ("Anderson")

Claim	Anderson
	To the extent this claim limitation is not expressly disclosed, Anderson renders obvious to one skilled in the art how to configure the strengthening member so that, when mounted in the vehicle, the strengthening member extends obliquely to the vertical direction of the vehicle.
Claim 4:	
[Preamble] A road vehicle comprising,	To the extent this preamble is deemed limiting, Anderson discloses a road vehicle. The strengthening member is for use in a road vehicle. For example, Figure 1 of Anderson shows a road vehicle. Fig. 1.  5.

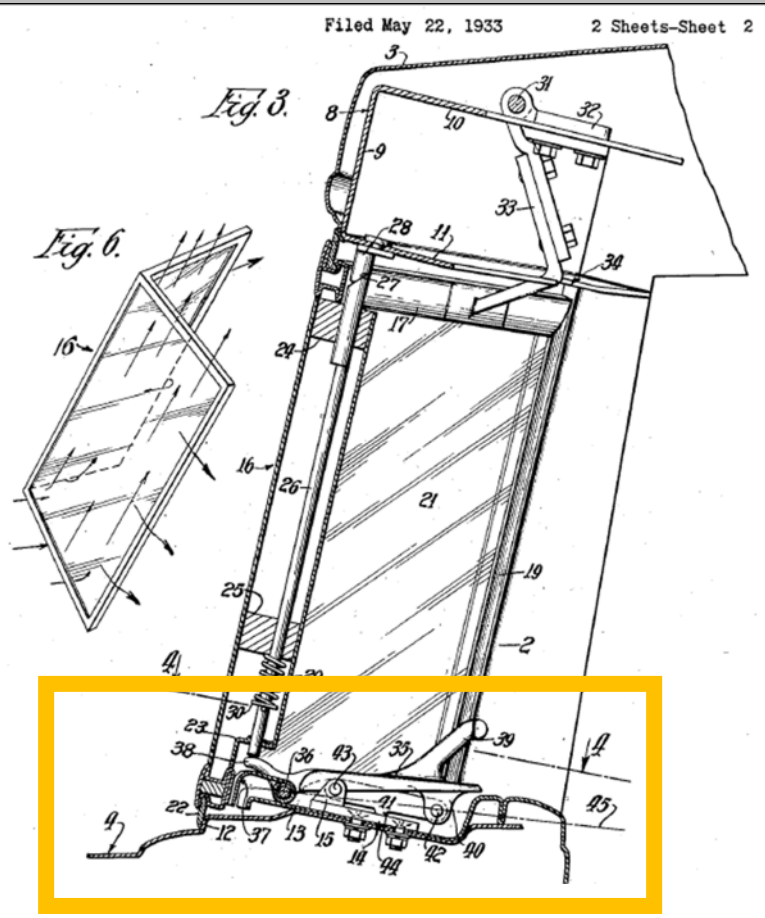
DEFENDANTS' INVALIDITY CONTENTIONS

EX. A-01 – Invalidity of U.S. Patent 7,494,178 Over U.S. Patent No. 1,965,625 ("Anderson")

Claim	Anderson
[a] at least one strengthening member fixed to a structure of the vehicle and extending in front of the driver's position,	Anderson discloses at least one strengthening member fixed to a structure of the vehicle and extending in front of the driver's position. For example, the strengthening member where at least one strengthening member fixed to a structure of the vehicle and extending in front of the driver's position. For example, Anderson describes how the center post is affixed to the frame of the vehicle. "The center post 20 which is comparatively narrow, considered transversely, is hollow and is offset at the bottom as at 23. . . . The front end of said leve is pivoted at 36 to a bracket 37 extending rearwardly from the bottom end of the center post at a point below its offset 23. This front end of said lever includes an extension 38 adapted for engagement with the bottom extremity of the locking rod 26 in the center post. The other end of said lever 35 includesan upwardly and rearwardly extending handle 39 and a depending ear 40. A link 41 is pivoted at one end as at 42 to said ear 40 and is pivoted at its other end as at 43 to the ear 15 of the bracket 14. This link is provided along one edge at a point between its ends with a shoulder lug 44, that normally engages on the bracket 14 when the windshield is in its closed and locked position." (2:54-56, 89-111). Further, Figure 3 shows, from a side-view, the strengthening member affixed to a structure of the vehicle (shown in the orange box below).

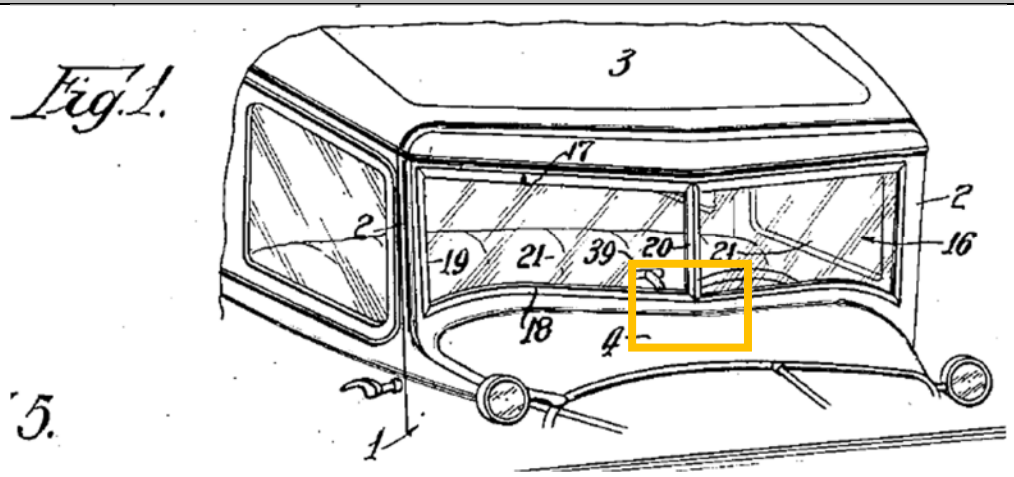
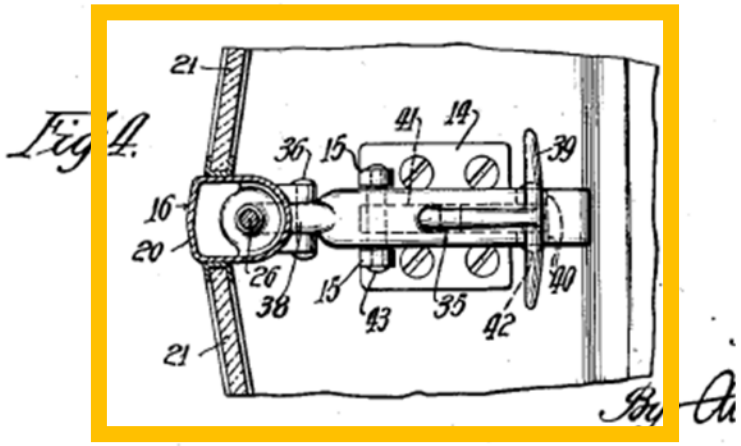
DEFENDANTS' INVALIDITY CONTENTIONS

EX. A-01 – Invalidity of U.S. Patent 7,494,178 Over U.S. Patent No. 1,965,625 ("Anderson")

Claim	Anderson
	 Similarly, Figure 1 shows from a front-view the strengthening member affixed to a structure of the vehicle (shown in the orange box below). Figure 1 also shows that the strengthening member extends in front of the driver's position because it shows the strengthening member situated in front of the steering while and driver seat.

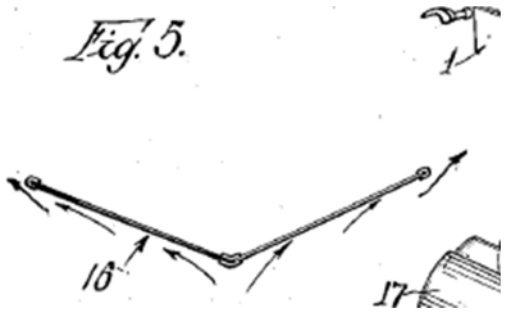
DEFENDANTS' INVALIDITY CONTENTIONS

EX. A-01 – Invalidity of U.S. Patent 7,494,178 Over U.S. Patent No. 1,965,625 ("Anderson")

Claim	Anderson
	 Figure 4 also shows, but from a bird's-eye view, the strengthening member affixed to a structure of the vehicle (shown in the orange box below). 

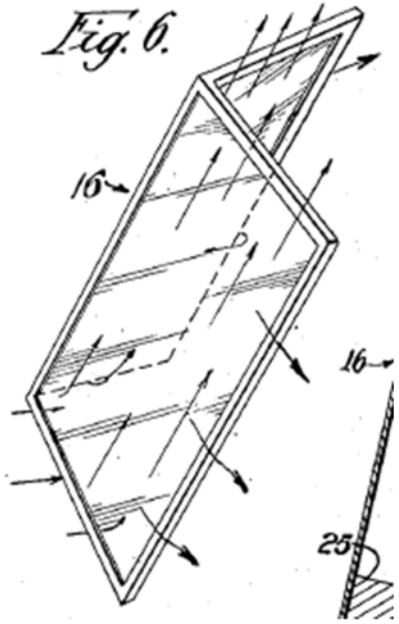
DEFENDANTS' INVALIDITY CONTENTIONS

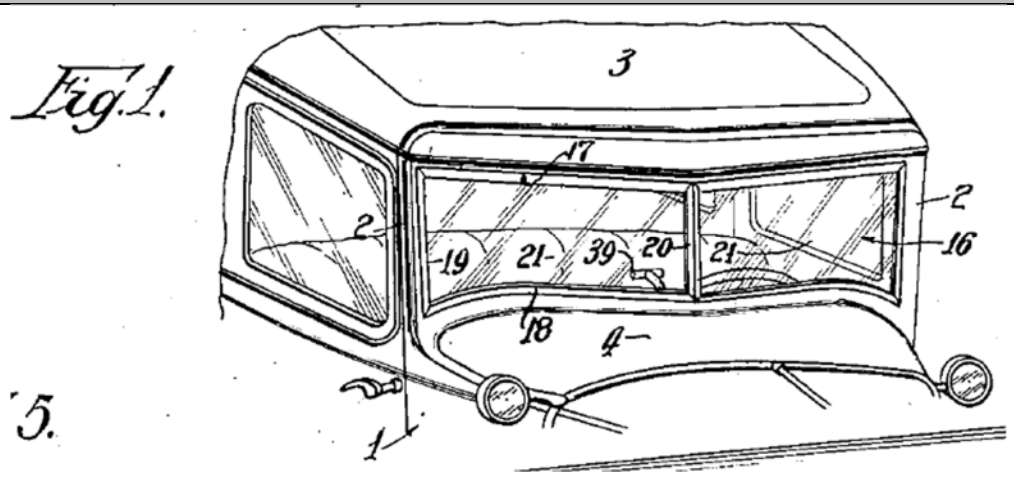
EX. A-01 – Invalidity of U.S. Patent 7,494,178 Over U.S. Patent No. 1,965,625 ("Anderson")

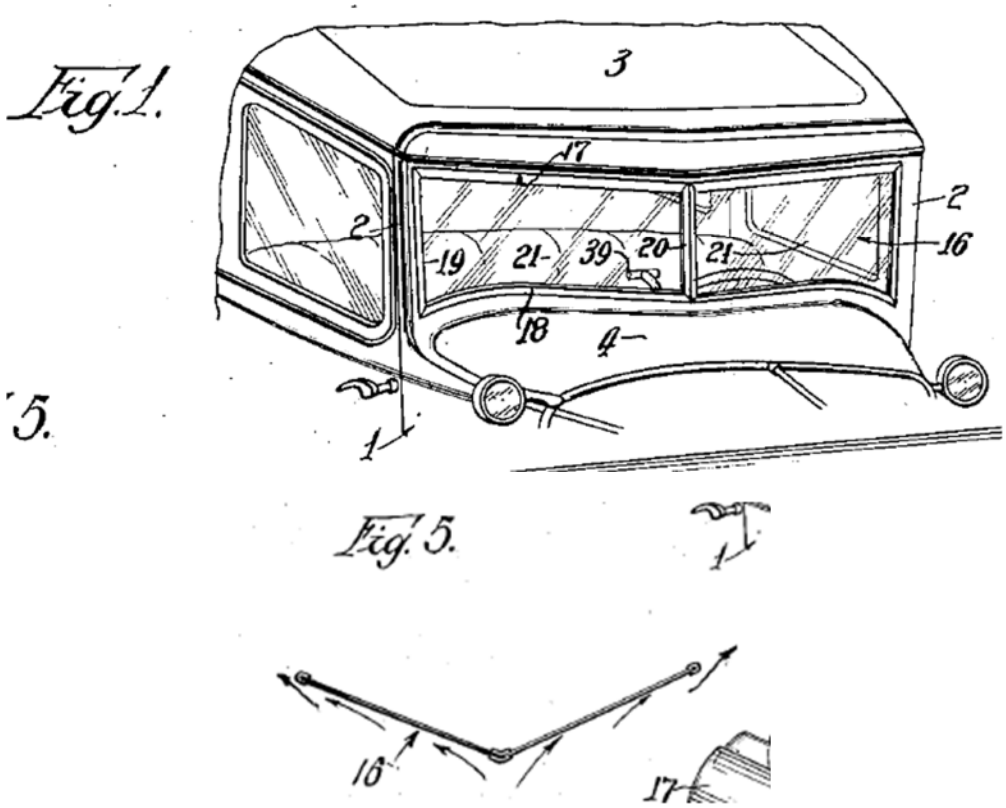
Claim	Anderson
[b][i] wherein the strengthening member is dimensioned so that the strengthening member will not prevent the driver from seeing an object which is at least two meters from the front windscreen, when the driver uses binocular vision and without requiring the driver to move the driver's head,	Anderson discloses a strengthening member wherein the strengthening member is dimensioned so that the strengthening member will not prevent the driver from seeing an object which is at least two meters from the front windscreen. For example, the strengthening member is dimensioned so that the strengthening member will not prevent the driver from seeing an object which is at least two meters from the front windscreen, when the driver uses binocular vision and without requiring the driver to move the driver's head. The Anderson specification recites that the "center post 20 which is comparatively narrow, considered transversely, is hollow . . . ." Figures 5 and 6 illustrate just how narrow the center post is designed to be (center post colored orange), and further illustrate the windscreen (colored blue). 

DEFENDANTS' INVALIDITY CONTENTIONS

EX. A-01 – Invalidity of U.S. Patent 7,494,178 Over U.S. Patent No. 1,965,625 ("Anderson")

Claim	Anderson
	 Further, Figure 1 illustrates the center post (colored orange) in relation to the steering wheel (colored dark green), which is thin, and a windscreen (colored blue).

Claim	Anderson
	 Alternatively, one skilled in the art would understand, based on the pictures and disclosure in Anderson alone, or in combination with one or more of the references charted in Exhibits A-1 to A-30, and the knowledge of one of ordinary skill in the art, that the strengthening member is dimensioned so that it would not prevent the driver from seeing objects in front of the vehicle. For example, it would have been obvious to one skilled in the art to modify the strengthening member structures disclosed in Anderson so it will not prevent the driver from seeing an object which is at least 2 m from the front windscreen, when the driver uses binocular vision, and without requiring the driver to move the driver's head, in view of the teachings of Anderson or, for example, as discussed in Defendants' Invalidity Contentions Cover Pleading at Section II.D.
[c] wherein the strengthening member has the form of a triangular prism which	Anderson discloses a strengthening member wherein the strengthening member has the form of a triangular prism which has been sheared in a vertical plane or the form of a truncated sheared triangular pyramid.

Claim	Anderson
has been sheared in a vertical plane or a truncated sheared triangular pyramid.	For example, the strengthening member wherein the strengthening member has the form of a triangular prism which has been sheared in a vertical plane or the form of a truncated sheared triangular pyramid. Figure 1 shows a strengthening member that meets this limitation. 

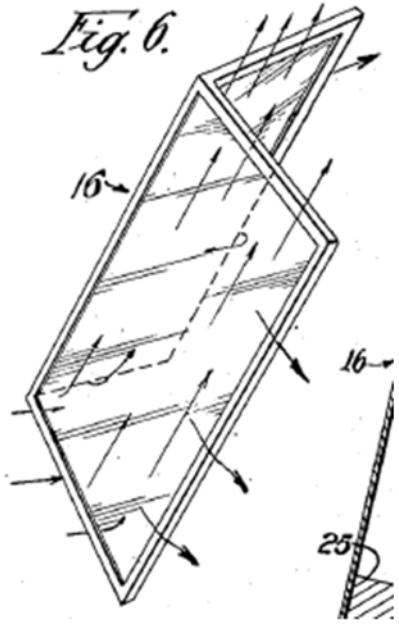
Claim	Anderson
	 Alternatively, one skilled in the art would understand, based on the pictures and disclosure in Anderson alone, or in combination with one or more of the references charted in Exhibits A-1 to A-30, and the knowledge of one of ordinary skill in the art, how to configure the strengthening member so that it has the form of a triangular prism which has been sheared in a vertical plane or the form of a truncated sheared triangular pyramid. For example, it would have been obvious to one skilled in the art to modify the strengthening member in Anderson to form a triangular prism sheared in a vertical plane or a truncated sheared triangular pyramid, in view of the teachings of Anderson or, for example, as discussed in Defendants' Invalidity Contentions Cover Pleading at Section II.D.

EXHIBIT F

EXHIBIT G

Dallara Stradale

from € 189,100

Length / Width / Alt.	Number of seats	Trunk	Warranty (years / km)
419/188/104 cm	2	100 liters	2 / unlimited

IN SUMMARY

Founded in 1972, Dallara Automobili is one of the best known names in the development and production of racing cars (for example, it collaborated on the definition of the Haas Formula 1 chassis). But the engineer Giampaolo

among the sports cars of the 60s, the Lamborghini Miura) had a dream: to build a car that bore his name and that was suitable for having fun not only on the track, but also on the road. A desire materialized in the Dallara Stradale, first GT "targabile" of the Emilian house. It is a sophisticated two-seater boat with a carbon fiber frame, and it is one of the closest numberable cars to racing cars. The engine, located behind the cockpit, is a Ford-derived 2.3 turbo 4-cylinder (like the six-speed manual gearbox), which delivers 400 hp. Considering the low weight of the Stradale (855 kg), the performance is a true supercar. The passenger compartment is essential, but there is no lack of air conditioning.

RECOMMENDED VERSION

The Dallara Stradale is basically offered in a version with a barchetta bodywork, which closely resembles racing cars. But, you can make the car more comfortable by fitting a wraparound windshield. By also adding the kit with the roof and the two glass doors (they open upwards), the Stradale turns into a coupé (thus configured the car is called GT). However, by removing the kit, the car can easily return to an open sports car. Also available are a striking rear wing and robotic shifting. Considering that each car is built by hand in the Varano de 'Melegari plant, the customer can request customization from custom-built cars.

BECAUSE YES

Performance Lovers of "hard and pure" sports driving will find something for their teeth.
Refinement From a technical point of view, the car is very sophisticated. For one thing, it has a carbon fiber frame.
Versatility With the special kit the Stradale can become a spider or a coupé.

WHY NOT

Comfort Although "usable" this is not the sports car for those who also want to move with ease in the city or face long motorway journeys.
GT version The price difference between the barchetta model and the one with the kit to transform the car into a coupé is high.
Visibility The rear is not the best.

Dallara Stradale

DO YOU LIKE THIS CAR?

Log in or register to vote

VOTES OF USERS

51
12
6
4
8

AVERAGE RATING

4.2

81

PHOTOGALLERY




RANGE

Standard in all versions

Abs
alloy wheels
electronic stability control
electronic traction control
self-locking rear differential
high efficiency headlights
leather interior
Bluetooth ready
front parking sensors
metallic paint

● = standard ○ = purchasable

PETROL

DISPLACEMENT CM ^{3} **2,300** CYLINDERS **4**
POWER CV / KW **400/294** MAX TORQUE NM **500**
EURO **6D-TEMP** TOP SPEED **280** KM / H
AVERAGE CONSUMPTION L / 100 KM **7**
CO $_2$ EMISSIONS G / KM **211** WEIGHT KG **855**

	manettini	comandi al volante del cambio	fari ad alta efficienza	climatizzatore	cerchi in lega	predisposizione Bluetooth	interni in pelle	sensori parcheggio anteriori	differenziale posteriore autobloccante	
Barchetta **€ 189.100**			●	○	●	●	●	●	●	CONFIGURA
Targa **€ 198.494**			●	○	●	●	●	●	●	CONFIGURA
Barchetta AMT **€ 204.838**	●	●	●	○	●	●	●	●	●	CONFIGURA
Targa AMT **€ 214.232**	●	●	●	○	●	●	●	●	●	CONFIGURA
GT **€ 227.652**			●	○	●	●	●	●	●	CONFIGURA
GT AMT **€ 243.390**	●	●	●	○	●	●	●	●	●	CONFIGURA

● = di serie ○ = acquistabile

NEWS

Dallara Stradale: una serie speciale per il Club Italia

potrebbero assicurarle un particolare valore collezionistico.

A Milano AutoClassica Dallara racconta

COMMENTI 1

In occasione della fiera dedicata alle auto d'epoca, Veloce.it premia l'ingegner Dallara che, in un'intervista, racconta la sua visione del futuro dell'auto.

Riparte la produzione della Dallara Stradale

COMMENTI 7

FOTO 3

After the stop due to the Covid-19 emergency, Dallara delivered the first example of the Stradale supercar.

Dallara Experience: the top driving course

COMMENTS 1

A special driving course for an even more special car, experienced firsthand and told by Veloce.it.

Dallara means technology

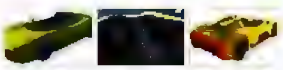
COMMENTS 9

PHOTO 16

There is an Italian company that excels in the design of racing and road cars. We visited it.

Dallara Stradale

from € 189,100



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Dallara Stradale

DO YOU LIKE THIS CAR?

Log in or register to vote

VOTES OF USERS

5	51
4	12
3	6
2	4
1	8

AVERAGE RATING

4.2

81

PHOTOGALLERY




RANGE

Standard in all versions

Abs
alloy wheels
electronic stability control
electronic traction control
self-locking rear differential
high efficiency headlights
leather interior
Bluetooth ready
front parking sensors
metallic paint

● = standard ○ = purchasable

PETROL

DISPLACEMENT CM ^{3} **2,300** CYLINDERS **4**
POWER CV / KW **400/294** MAX TORQUE NM **500**
EURO **6D-TEMP** TOP SPEED **280** KM / H
AVERAGE CONSUMPTION L / 100 KM **7**
CO $_2$ EMISSIONS G / KM **211** WEIGHT KG **855**

	manettini	comandi al volante del cambio	fari ad alta efficienza	climatizzatore	cerchi in lega	predisposizione Bluetooth	interni in pelle	sensori parcheggio anteriori	differenziale posteriore autobloccante	
Barchetta **€ 189.100**			●	○	●	●	●	●	●	CONFIGURA
Targa **€ 198.494**			●	○	●	●	●	●	●	CONFIGURA
Barchetta AMT **€ 204.838**	●	●	●	○	●	●	●	●	●	CONFIGURA
Targa AMT **€ 214.232**	●	●	●	○	●	●	●	●	●	CONFIGURA
GT **€ 227.652**			●	○	●	●	●	●	●	CONFIGURA
GT AMT **€ 243.390**	●	●	●	○	●	●	●	●	●	CONFIGURA

● = di serie ○ = acquistabile

NEWS

Dallara Stradale: una serie speciale per il Club Italia

potrebbero assicurarle un particolare valore collezionistico.

A Milano AutoClassica Dallara racconta

COMMENTI 1

In occasione della fiera dedicata alle auto d'epoca, Veloce.it premia l'ingegner Dallara che, in un'intervista, racconta la sua visione del futuro dell'auto.

Riparte la produzione della Dallara Stradale

COMMENTI 7

FOTO 3

After the stop due to the Covid-19 emergency, Dallara delivered the first example of the Stradale supercar.

Dallara Experience: the top driving course

COMMENTS 1

A special driving course for an even more special car, experienced firsthand and told by Veloce.it.

Dallara means technology

COMMENTS 9

PHOTO 16

There is an Italian company that excels in the design of racing and road cars. We visited it.

ADS

EXHIBIT H

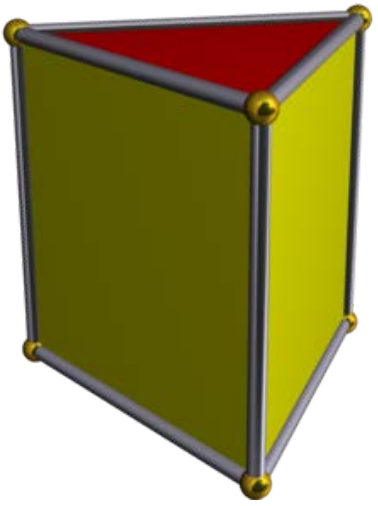
Triangular prism

In geometry, a **triangular prism** is a three-sided prism; it is a polyhedron made of a triangular base, a translated copy, and 3 faces joining corresponding sides. A **right triangular prism** has rectangular sides, otherwise it is *oblique*. A **uniform triangular prism** is a right triangular prism with equilateral bases, and square sides.

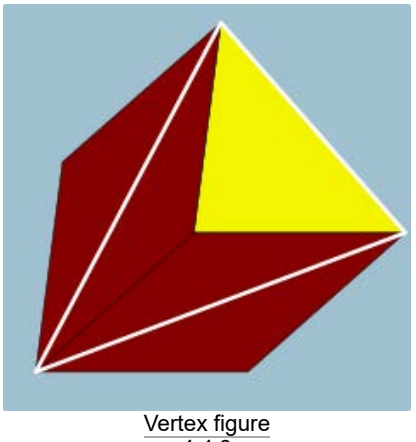
Equivalently, it is a polyhedron of which two faces are parallel, while the surface normals of the other three are in the same plane (which is not necessarily parallel to the base planes). These three faces are parallelograms. All cross-sections parallel to the base faces are the same triangle.

Contents

Uniform triangular prism



Type	Prismatic uniform polyhedron
Elements	$F = 5$, $E = 9$ $V = 6$ ($\chi = 2$)
Faces by sides	3{4}+2{3}
Schläfli symbol	t{2,3} or {3}×{}
Wythoff symbol	2 3 | 2
Coxeter diagram	
Symmetry group	D_{3h}, [3,2], (*322), order 12
Rotation group	D_3, $[3,2]^+$, (322), order 6
References	$U_{76(a)}$
Dual	Triangular dipyramid
Properties	convex



Vertex figure
4.4.3

As a semiregular (or uniform) polyhedron

A right triangular prism is semiregular or, more generally, a uniform polyhedron if the base faces are equilateral triangles, and the other three faces are squares. It can be seen as a **truncated trigonal hosohedron**, represented by Schläfli symbol t{2,3}. Alternately it can be seen as the Cartesian product of a triangle and a line segment, and represented by the product {3}x{}. The dual of a triangular prism is a triangular bipyramid.

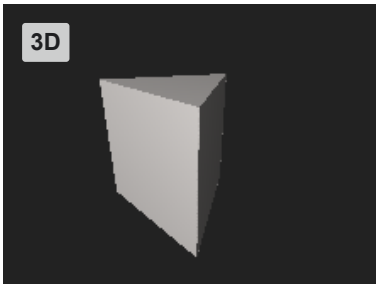
The symmetry group of a right 3-sided prism with triangular base is D_{3h} of order 12. The rotation group is D_3 of order 6. The symmetry group does not contain inversion.

Volume

The volume of any prism is the product of the area of the base and the distance between the two bases. In this case the base is a triangle so we simply need to compute the area of the triangle and multiply this by the length of the prism:

$$V = \frac{1}{2}bhl,$$

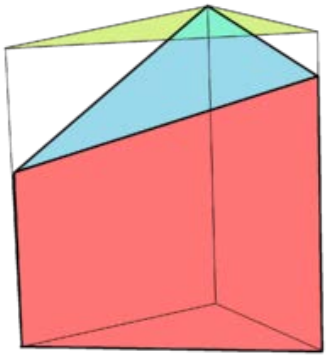
where b is the length of one side of the triangle, h is the length of an altitude drawn to that side, and l is the distance between the triangular faces.



3D model of a (uniform) triangular prism

Truncated triangular prism

A *truncated right triangular prism* has one triangular face truncated (planed) at an oblique angle.[1]

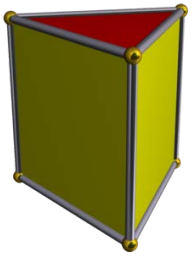
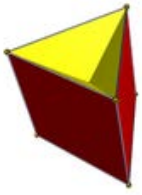
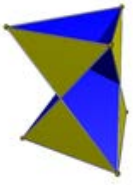


The volume of a truncated triangular prism with base area A and the three heights h_1, h_2, and h_3 is determined by[2]

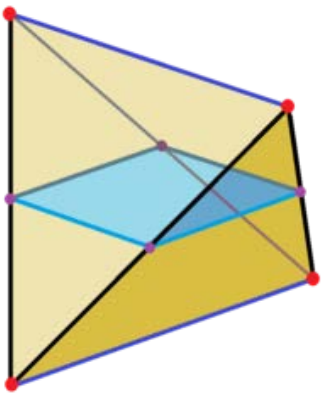
$$V = \frac{1}{3}A(h_1 + h_2 + h_3).$$

Facetings

There are two full D_{2h} symmetry facetings of a *triangular prism*, both with 6 isosceles triangle faces, one keeping the original top and bottom triangles, and one the original squares. Two lower C_{3v} symmetry faceting have one base triangle, 3 lateral crossed square faces, and 3 isosceles triangle lateral faces.

Convex	Facetings			
D_{3h} symmetry			C_{3v} symmetry	
				
2 {3} 3 {4}	3 {4} 6 ( ) v { }	2 {3} 6 ( ) v { }	1 {3} 3 t'{2} 6 ( ) v { }	1 {3} 3 t'{2} 3 ( ) v { }

Related polyhedra and tilings



A regular tetrahedron or tetragonal disphenoid can be dissected into two halves with a central square. Each half is a topological triangular prism.

Family of uniform prisms											
Polyhedron											
Coxeter											
Tiling											
Config.	2.4.4	3.4.4	4.4.4	5.4.4	6.4.4	7.4.4	8.4.4	9.4.4	10.4.4	11.4.4	12.4.4

Family of convex cupolae

n	2	3	4	5	6
Name	**{2} || t{2}**	**{3} || t{3}**	**{4} || t{4}**	**{5} || t{5}**	**{6} || t{6}**
Cupola	Digonal cupola	Triangular cupola	Square cupola	Pentagonal cupola	Hexagonal cupola (Flat)
Related uniform polyhedra	Triangular prism	Cubocta-hedron	Rhombi-cubocta-hedron	Rhomb-icosidodeca-hedron	Rhombi-trihexagonal tiling

Symmetry mutations

This polyhedron is topologically related as a part of sequence of uniform truncated polyhedra with vertex configurations (3.2n.2n), and [n,3] Coxeter group symmetry.

*n32 symmetry mutation of truncated tilings: t{n,3}											
Symmetry *n32 [n,3]	Spherical				Euclid.	Compact hyperb.		Paraco.	Noncompact hyperbolic		
	*232 [2,3]	*332 [3,3]	*432 [4,3]	*532 [5,3]	*632 [6,3]	*732 [7,3]	*832 [8,3]...	*∞32 [∞,3]	[12i,3]	[9i,3]	[6i,3]
Truncated figures											
Symbol	t{2,3}	t{3,3}	t{4,3}	t{5,3}	t{6,3}	t{7,3}	t{8,3}	t{∞,3}	t{12i,3}	t{9i,3}	t{6i,3}
Triakis figures											
Config.	V3.4.4	V3.6.6	V3.8.8	V3.10.10	V3.12.12	V3.14.14	V3.16.16	V3.∞.∞			

This polyhedron is topologically related as a part of sequence of cantellated polyhedra with vertex figure (3.4.n.4), and continues as tilings of the hyperbolic plane. These vertex-transitive figures have (*n32) reflectional symmetry.

This polyhedron is topologically related as a part of sequence of cantellated polyhedra with vertex figure (3.4.n.4), and continues as tilings of the hyperbolic plane. These vertex-transitive figures have (*n32) reflectional symmetry.

*n32 symmetry mutation of expanded tilings: 3.4.n.4								
Symmetry *n32 [n,3]	Spherical				Euclid.	Compact hyperb.		Paracomp.
	*232 [2,3]	*332 [3,3]	*432 [4,3]	*532 [5,3]	*632 [6,3]	*732 [7,3]	*832 [8,3]...	*∞32 [∞,3]
Figure								
Config.	3.4.2.4	3.4.3.4	3.4.4.4	3.4.5.4	3.4.6.4	3.4.7.4	3.4.8.4	3.4.∞.4

Compounds

There are 4 uniform compounds of triangular prisms:

Compound of four triangular prisms, compound of eight triangular prisms, compound of ten triangular prisms, compound of twenty triangular prisms.

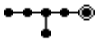
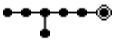
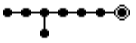
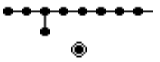
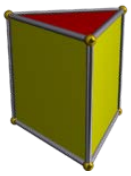
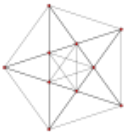
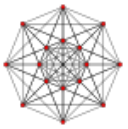
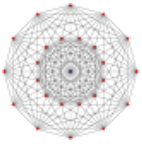
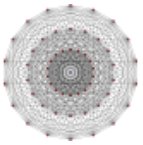
Honeycombs

There are 9 uniform honeycombs that include triangular prism cells:

Gyroelongated alternated cubic honeycomb, elongated alternated cubic honeycomb, gyrated triangular prismatic honeycomb, snub square prismatic honeycomb, triangular prismatic honeycomb, triangular-hexagonal prismatic honeycomb, truncated hexagonal prismatic honeycomb, rhombitriangular-hexagonal prismatic honeycomb, snub triangular-hexagonal prismatic honeycomb, elongated triangular prismatic honeycomb

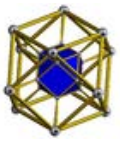
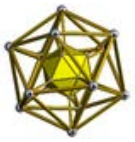
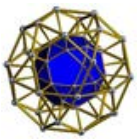
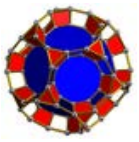
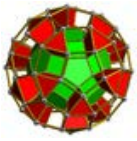
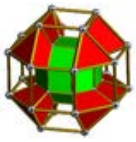
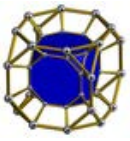
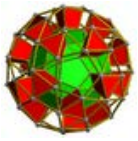
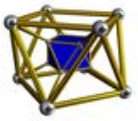
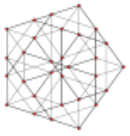
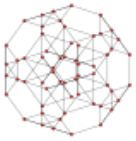
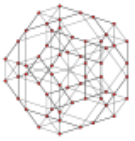
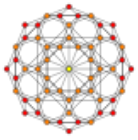
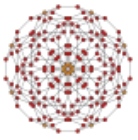
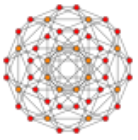
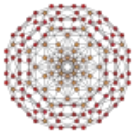
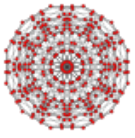
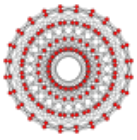
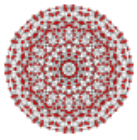
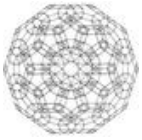
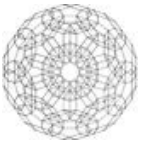
Related polytopes

The triangular prism is first in a dimensional series of semiregular polytopes. Each progressive uniform polytope is constructed vertex figure of the previous polytope. Thorold Gosset identified this series in 1900 as containing all regular polytope facets, containing all simplexes and orthoplexes (equilateral triangles and squares in the case of the triangular prism). In Coxeter's notation the triangular prism is given the symbol -1_{21}.

k_{21} figures in n dimensional								
Space	**Finite**						**Euclidean**	**Hyperbolic**
E_n	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Coxeter group	$E_3=A_2A_1$	$E_4=A_4$	$E_5=D_5$	E_6	E_7	E_8	$E_9 = \tilde{E}_8 = E_8^+$	$E_{10} = \bar{T}_8 = E_8^{++}$
Coxeter diagram								
Symmetry	$[3^{-1,2,1}]$	$[3^{0,2,1}]$	$[3^{1,2,1}]$	$[3^{2,2,1}]$	$[3^{3,2,1}]$	$[3^{4,2,1}]$	$[3^{5,2,1}]$	$[3^{6,2,1}]$
Order	12	120	1,920	51,840	2,903,040	696,729,600	∞	
Graph							-	-
Name	-1_{21}	0_{21}	1_{21}	2_{21}	3_{21}	4_{21}	5_{21}	6_{21}

Four dimensional space

The triangular prism exists as cells of a number of four-dimensional uniform 4-polytopes, including:

Four dimensional polytopes with triangular prisms							
Tetrahedral prism	Octahedral prism	Cuboctahedral prism	Icosahedral prism	Icosidodecahedral prism	Truncated dodecahedral prism		
							
Rhomb-icosidodecahedral prism	Rhombi-cuboctahedral prism	Truncated cubic prism	Snub dodecahedral prism	n-gonal antiprismatic prism			
							
Cantellated 5-cell	Cantitruncated 5-cell	Runcinated 5-cell	Runcitruncated 5-cell	Cantellated tesseract	Cantitruncated tesseract	Runcinated tesseract	Runcitruncated tesseract
							
Cantellated 24-cell	Cantitruncated 24-cell	Runcinated 24-cell	Runcitruncated 24-cell	Cantellated 120-cell	Cantitruncated 120-cell	Runcinated 120-cell	Runcitruncated 120-cell
							

See also

- Wedge (geometry)

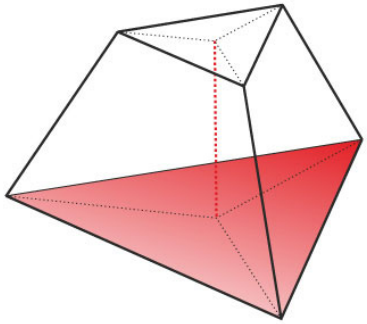
References

1. Kern, William F.; Bland, James R. (1938). *Solid Mensuration with proofs*. p. 81. OCLC 1035479 (https://www.worldcat.org/oclc/1035479).
2. "Volume of truncated prism" (https://math.stackexchange.com/q/2371139). *Mathematics Stack Exchange*. Retrieved 9 July 2019.

- Weisstein, Eric W. "Triangular prism" (https://mathworld.wolfram.com/TriangularPrism.html). *MathWorld*.
- Interactive Polyhedron: Triangular Prism (https://web.archive.org/web/20150417184747/http://polyhedra.org/poly/show/22/triangular_prism)
- Surface area and volume of a triangular prism (http://www.triangular-prism.com)

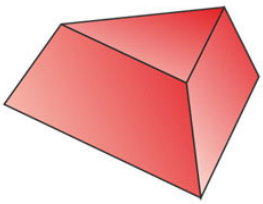
EXHIBIT I

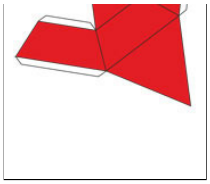
Truncated triangular pyramid



(/truncated-triangular-pyramid.html)

At the base of the pyramid is a regular triangle (all sides are equal, the angles between the base sides are 60 degrees). The height of the pyramid is exactly at the center of the triangular base.

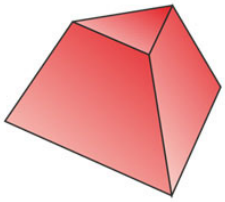


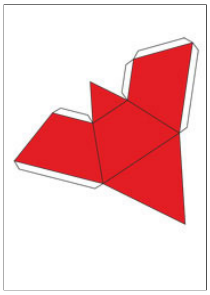


(/images/polyhedra/301/net_truncated_triangular_pyramid_3_1.pdf)

Download the net of the truncated triangular pyramid for printing on A4 sheet (/images/polyhedra/301/net_truncated_triangular_pyramid_3_1.pdf)

Geometric dimensions of the finished pyramid (mm):
Height = 35
this pyramid can be inscribed in a truncated cone with base radii r = 35 mm and R = 55 mm

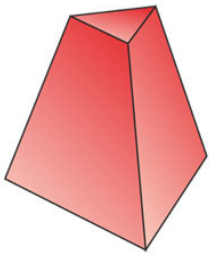


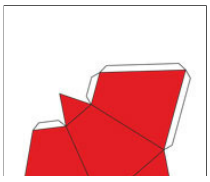


(/images/polyhedra/301/net_truncated_triangular_pyramid_3_2.pdf)

Download the net of the truncated triangular pyramid for printing on A4 sheet (/images/polyhedra/301/net_truncated_triangular_pyramid_3_2.pdf)

Geometric dimensions of the finished pyramid (mm):
Height = 50
this pyramid can be inscribed in a truncated cone with base radii r = 25 mm and R = 50 mm

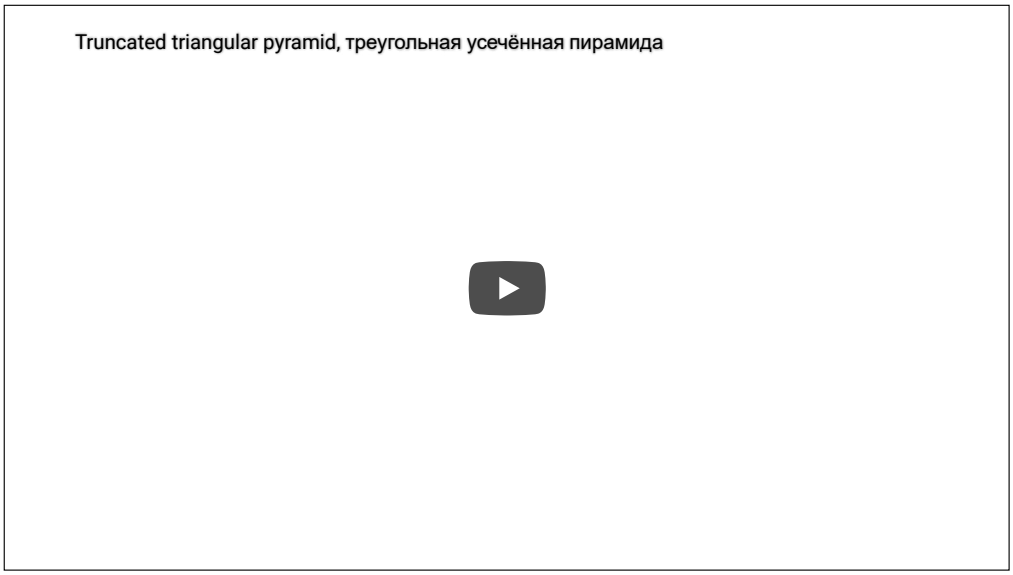




(/images/polyhedra/301/net_truncated_triangular_pyramid_3_3.pdf)

Download the net of the truncated triangular pyramid for printing on A4 sheet (/images/polyhedra/301/net_truncated_triangular_pyramid_3_3.pdf)

Geometric dimensions of the finished pyramid (mm):
Height = 80
this pyramid can be inscribed in a truncated cone with base radii r = 20 mm and R = 50 mm



see other Truncated pyramids (/truncated-pyramids2.html)

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